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ERRATA

NSA, Vol. 6, No. 7. In abstract 2079, p. 263, and in AECD-3317, p. ii, author E. A. Fromm should be E. O. Fromm.

NSA, Vol. 6, No. 9. In abstract 2658, p. 327, and in NP-3990, p. viii, corporate author Air Univ., School of Aviation Medicine should be Northwestern Univ. Medical School.

NSA, Vol. 6, No. 14. In abstract 3957, p. 489, and in Reports Reference List, p. vi, report number TID-369 (pt. E) should be TID-369.

NSA, Vol. 6, No. 17. In abstract 5175, p. 631, and in AECU-2132, p. ii, author Glenn W. Roe should be Glenn M. Roe.

NSA, Vol. 6, No. 21. In abstract 5960, p. 731, and in TID-5086(1st Rev.), p. vi, the date of issue May 15, 1952 should be Sept. 3, 1952.

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AECD-3485 1415
Knolls Atomic Power Lab.
ULTRASONIC TESTING OF SMALL-DIAMETER TUBING, by A. J. Pardus. Feb. 1, 1952. Decl. Dec. 16, 1952. 30p. (AECD-3485; KAPL-808)

U. S. ATOMIC ENERGY COMMISSION UNCLASSIFIED REPORTS

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FINAL REPORT [ON] PETROGRAPHIC AND MINERALOGICAL STUDIES OF LOS ALAMOS, NEW MEXICO ROCK SAMPLES RELATED TO WASTE DISPOSAL, by Carl W. Beck. Sept. 5, 1952. 34p. (AECU-2325)

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EXTERNAL AND INTERNAL EXPOSURE TO IONIZING RADIATION AND MAXIMUM PERMISSIBLE CONCENTRATION (MPC) OF RADIOACTIVE CONTAMINATION IN AIR AND WATER FOLLOWING AN ATOMIC EXPLOSION, by K. Z. Morgan and C. P. Straub. Apr. 4, 1952. 17p. (AECU-2332)

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Pennsylvania Univ. School of Medicine
LIGHT AND ELECTRON MICROSCOPIC STUDIES OF ESCHERICHIA COLI–COLIPHAGE INTERACTIONS. III. PERSISTENCE OF MITOCHONDRIA AND REDUCTASE ACTIVITY DURING INFECTION OF E. COLI B WITH T_2 PHAGE by Philip E. Hartman, Stuart Mudd, James Hillier, and Ernst H. Beutner. Pennsylvania Univ. School of Medicine and RCA Labs. [Div., Radio Corp. of America.] [nd] 19p. (AECU-2333)

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THE MOBILITY OF SKELETAL PHOSPHORUS IN A MATURE DAIRY COW AS DETERMINED WITH RADIOACTIVE PHOSPHORUS, by A. L. Black, M. Kleiber, A. H. Smith, and N. P. Ralston. California Univ., Davis, School of Veterinary Medicine and California Univ., Davis, Coll. of Agriculture. [nd] 11p. (AECU-2334)

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A CYTOLOGICAL INVESTIGATION OF THE MITOCHONDRIA OF THREE STRAINS OF SALMONELLA, TYPHOSA, by John C. Davis, Loren C. Winterscheid, Philip E. Hartman, and Stuart Mudd. [nd] 23p. (AECU-2335)

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BASEMENT MEMBRANES IN CHRONIC INTESTINAL DISEASES, by Sheldon C. Sommers, Lilla M. Anderson, and Shields Warren. [nd] 7p. (AECU-2337)

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LINEAR ELECTRON ACCELERATOR: TECHNICAL REPORT NO. I [ON] TRANSVERSE MOTION OF AN ELECTRON IN A CONSTANT WAVE SPEED SECTION OF A LINEAR ACCELERATOR, by Ira Jacobs and E. S. Akeley. June 1952. 44p. (AECU-2338; Technical Report No. I)

AECU-2340 1515
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PROGRESS REPORT [ON] LINEAR ELECTRON ACCELERATOR. June 15, 1951. 40p. (AECU-2340)

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AN APPARATUS FOR RESEARCH IN VACUUM-FUSION ANALYSIS, by William S. Horton. [nd] 19p. (AECU-2342)

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Institute for Cancer Research, Philadelphia
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THE FREQUENCIES OF SUBVITALS IN EXPERIMENTAL POPULATIONS OF DROSOPHILA MELANOGASTER, by Bruce Wallace and Carol Madden. [nd] 24p. (AECU-2348)

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DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT FOR MAY, JUNE, JULY, 1952. Austin M. Brues, ed. [nd] 116p. (ANL-4840)

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CHRONIC EXTERNAL IRRADIATION, NEUTRON RADIOBIOLOGY, HEMATOLOGY, PHYSIOLOGY, HISTOPATHOLOGY, AND RADIUM TOXICITY, p.10-56 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT FOR MAY, JUNE, JULY, 1952. Austin M. Brues, ed. [nd] 47p. (ANL-4840(p.10-56))

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EXPERIMENTAL PATHOLOGY, SPECIAL PROBLEMS, INVERTEBRATE ZOOLOGY, MICROBIOLOGY, PHYTORADIOBIOLOGY, PHYSIOLOGICAL CHEMISTRY, ORGANIC CHEMISTRY, PHYSICAL CHEMISTRY, PHARMACOLOGY, THEORETICAL BIOLOGY, AND BIOPHYSICS, p.57-108 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT FOR MAY, JUNE, JULY, 1952. Austin M. Brues, ed. [nd] 52p. (ANL-4840(p.57-108))

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NUCLEAR ALIGNMENT AND THE ENTROPY OF LIQUID He^3, by Bernard Weinstock, Bernard M. Abraham, and Darrell W. Osborne. Nov. 1952. 8p. (ANL-4931)

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COO-123 1432
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REPORT NO. 9 [ON] PHASE DIAGRAMS OF ZIRCONIUM-BASE BINARY ALLOYS FOR OCTOBER 1–DECEMBER 31, 1952; THE ZIRCONIUM-OXYGEN SYSTEM, REPORT NO. 3, by Robert F. Domagala and Donald J. McPherson. Dec. 31, 1952. 7p. (COO-123; Report No. 9; Report No. 3)

ISC-252 1527
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RADIATIONS FROM SELENIUM 75, by Erling N. Jensen, L. Jackson Laslett, Don S. Martin, Jr., Francis J. Hughes, and William W. Pratt. [nd] 22p. (ISC-252)

KAPL-661 1408
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SOLUBILITY OF CARBON DIOXIDE IN DRY TOLUENE AND SCINTILLATION COUNTING OF C^{14} CARBON DIOXIDE, by D. L. Williams. Oct. 1952. 14p. (LA-1484)

MIT-1103 1434
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North American Aviation, Inc.
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NAA-SR-201 1390
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SIMPLE EQUIPMENT AND TECHNIQUES FOR A SMALL CRYOGENICS LABORATORY, by N. S. Rasor. Issued Jan. 8, 1953. 29p. (NAA-SR-201)

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PHOTOCHEMICAL REACTIONS OF COMPLEX MOLECULES IN CONDENSED PHASE, by Henry Linschitz. Dec. 15, 1951. 30p. (NYO-655)

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PROGRESS REPORT [ON] THE HEAT CAPACITY OF $MgCd_3$ BETWEEN 12 AND 320°K; THE LOW TEMPERATURE TRANSFORMATION(S) AND THE RESIDUAL ENTROPY OF $MgCd_3$ SUPERLATTICE [FOR] OCTOBER 1, 1952–JANUARY 1, 1953, by R. S. Craig, W. E. Wallace, L. W. Coffer, and C. A. Krier. Jan. 14, 1953. 7p. (NYO-951)

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PROGRESS REPORT [ON] STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES, by F. H. Norton, W. D. Kingery, et al. Jan. 1, 1953. 4p. (NYO-3142)

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ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS; QUARTERLY PROGRESS REPORT [FOR] PERIOD ENDING OCTOBER 1, 1952, by Robert F. Mehl and Gerhard Derge. Dec. 31, 1952. 23p. (NYO-3692)

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A CALCULATION OF THE PROTON-ELECTRON ANGULAR

CORRELATION FOR NEUTRON DECAY, by H. L. Reynolds, L. C. Biedenharn, Jr., and D. B. Beard. Issued Jan. 22, 1953. 15p. (ORNL-1444)

RMO-566 1426
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MINERAL ASSOCIATIONS IN THE URANIUM DEPOSITS OF THE COLORADO PLATEAU AND ADJACENT REGIONS WITH SPECIAL EMPHASIS ON THOSE IN THE SHINARUMP FORMATION; PART III. ANNUAL REPORT [FOR] JULY 1, 1951 TO JUNE 30, 1952, by John W. Gruner and Lynn Gardiner. Nov. 1, 1952. 40p. (RMO-566)

SEP-87 1443
Sylvania Electric Products, Inc., Atomic Energy Div.
MECHANICAL PROPERTIES OF ZIRCONIUM, by F. D. Rosi and F. C. Perkins. Issued Dec. 9, 1952. 23p. (SEP-87)

TID-3032 1539
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RADIATION SHIELDS AND SHIELDING; A BIBLIOGRAPHY OF UNCLASSIFIED AEC REPORT LITERATURE. Charles J. Engberg, comp. Sept. 1952. 26p. (TID-3032)

UCLA-233 1477
Atomic Energy Project, Univ. of Calif., Los Angeles
SHOCK WAVE PRESSURE MEASUREMENTS BY A VELOCITY COMPARISON METHOD, by Brian Dunne and Benedict Cassen. Issued Nov. 10, 1952. 13p. (UCLA-233)

UCRL-1954 1478
Radiation Lab., Univ. of Calif., Berkeley
CALCULATION OF GEOMETRICAL EFFICIENCY OF COUNTERS, by Louis R. Henrich. Aug. 8, 1952. 12p. (UCRL-1954)

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ABSORPTION SPECTROSCOPY IN LIQUID AMMONIA, by William L. Jolly. Oct. 1952. 22p. (UCRL-2008)

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SEPARATION OF TANTALUM AND NIOBIUM BY SOLVENT EXTRACTION, by Peter C. Stevenson and Harry G. Hicks. Nov. 12, 1952. 13p. (UCRL-2009)

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Radiation Lab., Univ. of Calif., Berkeley
THE SCATTERING AND ABSORPTION OF POSITIVE PI MESONS BY ALUMINUM (thesis), by James Frueh Tracy. Nov. 16, 1952. 73p. (UCRL-2013)

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Radiation Lab., Univ. of Calif., Berkeley
A POSSIBLE PRIMARY QUANTUM CONVERSION ACT OF PHOTOSYNTHESIS, by M. Calvin and J. A. Barltrop. Dec. 5, 1952. 7p. (UCRL-2024)

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UR-222 1334
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QUARTERLY TECHNICAL REPORT [FOR] JULY 1, 1952 THRU SEPTEMBER 30, 1952. Nov. 3, 1952. 57p. (UR-222)

UR-228 1323
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AN IMPROVED DETERMINATION OF EXCHANGEABLE IONS IN BONE PREPARATIONS, by John H. Weikel, Jr. and William F. Neuman. Nov. 13, 1952. 14p. (UR-228)

UR-230 1368
Atomic Energy Project, Univ. of Rochester
THE SURFACE CHEMISTRY OF BONE: VII. THE HYDRATION LAYER, by W. F. Neuman, T. Y. Toribara, and B. J. Mulryan. Nov. 18, 1952. 23p. (UR-230)

Y-F17-9 1418*
Oak Ridge National Lab., Y-12 Area
PERFORMANCE CHARACTERISTICS FOR A GENERAL ELECTRIC G-3 ELECTROMAGNETIC PUMP, by A. G. Grindell. Oct. 24, 1951. 14p. (Y-F17-9)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE-C/R-521 1378
Atomic Energy Research Establishment, Harwell, Berks (England)
THE SPECTROPHOTOMETRIC DETERMINATION OF SILICON IN BISMUTH OXIDE OR METAL, by M. Gibson. May 1950. 18p. (AERE-C/R-521)

AERE-C/R-980 1379
Atomic Energy Research Establishment, Harwell, Berks (England)
DETERMINATION OF THE ^{235}U CONTENT OF MIXTURES OF THE NATURALLY OCCURRING URANIUM ISOTOPES BY RADIOACTIVATION, by A. P. Seyfang and A. A. Smales. Oct. 3, 1952. 23p. (AERE-C/R-980)

AERE-C/R-990 1372
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THE SYSTEM BORON TRIFLUORIDE – METHANOL, by N. N. Greenwood. Aug. 11, 1952. 27p. (AERE-C/R-990)

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A STUDY OF MONO-LAYER ADSORPTION OF TWO SPECIES ON NON-UNIFORM SURFACES, by E. Glueckauf. Aug. 1952. 40p. (AERE-C/R-999)

AERE-C/R-1002 1321
Atomic Energy Research Establishment, Harwell, Berks (England)
THE SPECTROGRAPHIC ESTIMATION OF TRACE ELEMENTS IN ANIMAL EYE LENSES, by M. L. Sizeland. Aug. 30, 1952. 12p. (AERE-C/R-1002)

AERE-C/R-1004 1407
Atomic Energy Research Establishment, Harwell, Berks (England)
A SIMPLE R. F. HEAT SEALING DEVICE FOR THIN PLASTIC CONTAINERS, by W. R. E. Maton. Aug. 16, 1952. 15p. (AERE-C/R-1004; HD-744)

AERE-C/R-1023 1401
Atomic Energy Research Establishment, Harwell, Berks (England)
THE INFRA-RED SPECTRA AND MOLECULAR STRUCTURE OF SOME INORGANIC HEXAFLUORIDES: PART 2. WF_6 AND MoF_6, by J. Gaunt. Oct. 22, 1952. 8p. (AERE-C/R-1023)

AERE-CE/R-910 1398
Atomic Energy Research Establishment, Harwell, Berks (England)
LIQUID-LIQUID EXTRACTION: A CRITICAL SURVEY OF THE LITERATURE DEALING WITH THE MECHANISM OF TRANSFER OF SOLUTES ACROSS PHASE BOUNDARIES WITH SPECIAL REFERENCE TO LIQUID-LIQUID INTERFACES, by J. B. Lewis. Nov. 1950. 21p. (AERE-CE/R-910)

AERE-E/R-754 1373
Atomic Energy Research Establishment, Harwell, Berks (England)
THE SOLUBILITY OF HELIUM IN CERTAIN TYPICAL LUBRICANTS AND MERCURY, by T. R. Moss. Sept. 1951. 16p. (AERE-E/R-754)

AERE-EL/R-750 1472
Atomic Energy Research Establishment, Harwell, Berks (England)
A TRANSPORTABLE RADIOACTIVITY MONITORING EQUIPMENT USED FOR GEOLOGICAL SURVEYING BY CAR, by D. H. Peirson. Oct. 5, 1951. 17p. (AERE-EL/R-750; HDS-230)

AERE-G/R-1020 1464
Atomic Energy Research Establishment, Harwell, Berks (England)
ACCURACY LIMITATIONS IN DETERMINATIONS OF PARTICLE ENERGIES AND VECTOR MOMENTA IN NUCLEAR EMULSIONS, by J. J. Wilkins. Sept. 23, 1952. 24p. (AERE-G/R-1020; HD-771)

AERE-M/R-978 1394
Atomic Energy Research Establishment, Harwell, Berks (England)
THE DECOMPOSITION OF POLYTETRAFLUORETHYLENE BY PILE RADIATION, by A. Charlesby. July 10, 1952. 10p. (AERE-M/R-978)

AERE-M/R-1003 1523
Atomic Energy Research Establishment, Harwell, Berks (England)
THE EFFECT OF PILE RADIATION ON THE DENSITY AND MELTING OF POLYTHENE, by A. Charlesby and M. Ross. Aug. 21, 1952. 21p. (AERE-M/R-1003)

AERE-M/R-1014 1451
Atomic Energy Research Establishment, Harwell, Berks (England)
IONIC CURRENTS IN THIN FILMS OF ZIRCONIUM OXIDE, by A. Charlesby. Sept. 23, 1952. 25p. (AERE-M/R-1014)

AERE-M/R-1015 1452
Atomic Energy Research Establishment, Harwell, Berks (England)
ELECTRON AND PHOTOCURRENTS IN THIN FILMS OF ZIRCONIUM OXIDE, by A. Charlesby. Sept. 23, 1952. 10p. (AERE-M/R-1015)

AERE-M/R-1016 1546
Atomic Energy Research Establishment, Harwell, Berks (England)
A HIGH TEMPERATURE ADIABATIC CALORIMETER; THE SPECIFIC HEAT OF URANIUM BETWEEN 100° AND 800°C, by J. M. North. Sept. 23, 1952. 19p. (AERE-M/R-1016)

AERE-M/R-1017 1416
Atomic Energy Research Establishment, Harwell, Berks (England)
MICROHARDNESS TESTING OF METALS: PART I. EXPERIMENTS ON TWO TYPES OF TESTER, by B. W. Mott and S. D. Ford and PART II. AN ANALYSIS OF THE VARIATION OF MICROHARDNESS WITH LOAD, by E. R. W. Jones. Sept. 23, 1952. 40p. (AERE-M/R-1017)

AERE-M/R-1027 1547
Atomic Energy Research Establishment, Harwell, Berks (England)
THE SYSTEM URANIUM-LEAD, by J. T. Maskrey and B. P. T. Frost. Oct. 14, 1952. 27p. (AERE-M/R-1027)

AERE-R/R-961 1506
Atomic Energy Research Establishment, Harwell, Berks (England)
THE MEASUREMENT OF AN ABSOLUTE THERMAL NEUTRON DENSITY IN G.L.E.E.P., by D. J. Littler and E. E. Lockett. Sept. 5, 1952. 15p. (AERE-R/R-961)

AERE-R/R-1019 1473
Atomic Energy Research Establishment, Harwell, Berks (England)
ABSOLUTE NEUTRON DENSITY DETERMINATIONS USING COBALT, by D. J. Littler and R. H. Thomas. Sept. 16, 1952. 8p. (AERE-R/R-1019)

AERE-R/R-1035 1507
Atomic Energy Research Establishment, Harwell, Berks (England)
SOME COMMENTS ON THE CALIBRATIONS OF THE HARWELL NEUTRON SOURCE AND THE G.L.E.E.P. NEUTRON DENSITY, by D. J. Littler and E. E. Lockett. Oct. 7, 1952. 5p. (AERE-R/R-1035; HD-781)

AERE-T/M-68 1517
Atomic Energy Research Establishment, Harwell, Berks (England)
PHASE DEBUNCHING BY FOCUSSING-FOILS IN A PROTON LINEAR ACCELERATOR, by J. S. Bell. Sept. 1952. 12p. (AERE-T/M-68)

AERE-T/R-1006 1463
Atomic Energy Research Establishment, Harwell, Berks (England)
THE IONIZATION BY ELECTRON IMPACT OF EXCITED HYDROGEN ATOMS, by F. Mandl. Aug. 1952. 13p. (AERE-T/R-1006)

AERE-T/R-1008 1494
Atomic Energy Research Establishment, Harwell, Berks (England)
A METHOD OF MEASURING THE AVERAGE ENERGY OF A NEUTRON SPECTRUM IN THE RANGE 0.3 TO 3.0 M.e.v., by M. E. Mandl. Aug. 1952. 12p. (AERE-T/R-1008)

AERE-T/R-1026 1430
Atomic Energy Research Establishment, Harwell, Berks (England)
CALCULATION OF THE SHAPE OF THE CONCENTRATION CONTOURS IN GRAIN-BOUNDARY DIFFUSION, by R. T. P. Whipple. July 1952. 22p. (AERE-T/R-1026; HD-782)

CRLIR-81 1349
Chemical and Radiological Labs., Army Chemical Center
MAXIMUM ALLOWABLE CONCENTRATIONS OF FISSION PRODUCTS IN THE AIR AS A FUNCTION OF EXPOSURE TIME AND TIME AFTER DETONATION (Continued), by Robert L. Harvey. Jan. 16, 1952. 11p. (CRLIR-81)

CRT-526 1471
Chalk River Project (Canada)
COULOMB FUNCTIONS FOR LARGE VALUES OF THE

PARAMETER η, by T. D. Newton. Dec. 1, 1952. 10p. (CRT-526)

G-123 1424
Bureau of Reclamation, Dept. of the Interior
FIELD TESTS FOR THE UNITED STATES ATOMIC ENERGY COMMISSION ON THE USE OF THE SEISMIC GEOPHYSICAL METHOD FOR TRACING "BURIED CHANNELS" IN THE MONUMENT VALLEY AREA, ARIZONA, by Dart Wantland and Robert D. Casey. Nov. 15, 1952. 51p. (G-123)

GS-C-207 1425
Geological Survey
RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN THE SOUTHERN COOK INLET REGION, ALASKA, 1949, by Robert M. Moxham and Arthur E. Nelson. 1952. 8p. (GS-C-207)

NBS-2020 1466
Office of Basic Instrumentation, National Bureau of Standards
A PHASE-SAMPLING TELEMETER, by M. G. Pawley and J. O. Dick. Sept. 29, 1952. 25p. (NBS-2020)

NBS-2036 1474
Office of Basic Instrumentation, National Bureau of Standards
AN EVALUATION STUDY OF A FAST-NEUTRON SPECTROMETER BASED ON THE TOTAL ABSORPTION PRINCIPLE, by Marshall R. Cleland. Oct. 27, 1952. 44p. (NBS-2036)

NBS-2065 1467
Office of Basic Instrumentation, National Bureau of Standards
A STUDY OF THE PERFORMANCE OF PHOTOMULTIPLIERS OPERATED AT HIGH VOLTAGE, by Ben Petree and Frank Viera, Jr. Nov. 17, 1952. 24p. (NBS-2065)

NBS-2091 1475
Radiation Physics Lab., National Bureau of Standards
COBALT 60 RANGE FOR THE CALIBRATION OF DOSE AND DOSE RATE METERS, by Giles E. Brown. Dec. 2, 1952. 40p. (NBS-2091)

NBS-2122 1476
Radiation Physics Lab., National Bureau of Standards
CALIBRATION STUDY OF TRACERLAB MODEL SU-13 RADIACMETER, by T. P. Loftus. Dec. 22, 1952. 6p. (NBS-2122)

NBS-CIR-535 1403
National Bureau of Standards
AN ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES ON THE SOLID-STATE REACTIONS OF THE URANIUM OXIDES, by S. M. Lang. Issued Jan. 9, 1953. 95p. (NBS-CIR-535)

NM-001-059.16.06 1520
Naval School of Aviation Medicine, Pensacola
MEASUREMENT OF BETA RAY BACKSCATTERING BY RADIOAUTOGRAPHY OF MONOLAYERS, by Dietrich E. Beischer. Nov. 20, 1951. 14p. (NM-001-059.16.06)

NM-001 059.16.08 1454
Naval School of Aviation Medicine, Pensacola
MELTING PHENOMENA OF A SURFACE OF MONOMOLECULAR THICKNESS, by Dietrich E. Beischer. Feb. 1, 1952. 5p. (NM-001 059.16.08)

NP-4244 1437
Utah Univ.
PROGRESS REPORT NUMBER I [ON] THE HIGH TEMPERATURE OXIDATION OF METALS [FOR] DECEMBER 1, 1951 TO FEBRUARY 29, 1952, by W. Martin Fassell, Jr. Mar. 1, 1952. 11p. AND APPENDIX I. THE HIGH PRESSURE OXIDATION RATE OF METALS. I. COPPER IN OXYGEN, by William McKewan and W. Martin Fassell. Jr. [nd] 17p. (NP-4244; Progress Report No. 1)

NP-4247 1331
Air Force Radiation Lab., Univ. of Chicago
QUARTERLY PROGRESS REPORT NO. 5. Oct. 15, 1952. 82p. (NP-4247; Quarterly Progress Report No. 5)

NP-4247(p.1-17) 1332
Air Force Radiation Lab., Univ. of Chicago
[Pages 1-17 of] QUARTERLY PROGRESS REPORT NO. 5. Oct. 15, 1952. 17p. (NP-4247(p.1-17))

NP-4247(p.18-82) 1333
Air Force Radiation Lab., Univ. of Chicago
[Pages 18-82 of] QUARTERLY PROGRESS REPORT NO. 5. Oct. 15, 1952. 65p. (NP-4247(p.18-82))

NP-4296 1315
Operations Analysis Div., Army Air Force
OPERATIONS ANALYSIS TECHNICAL MEMORANDUM NO. 25 [ON] BOMBING ACCURACY AND DAMAGE FROM ATOMIC BOMBS; AN INTRODUCTION, by Hugh J. Miser. Aug. 15, 1951. 41p. (NP-4296; Operations Analysis Tech. Memo. 25)

NP-4299 1446
Naval School of Aviation Medicine, Pensacola
SURFACE DIFFUSION OF RADIOACTIVE MONOLAYERS AND A NEW METHOD OF DETECTING ACTIVE PATCHES AND SURFACE CRACKS, by Dietrich E. Beischer. Dec. 29, 1951. 21p. (NP-4299; U-21226)

NP-4304 1438
Metallurgical Advisory Committee on Titanium
MINUTES OF CONFERENCE ON CRYSTALLOGRAPHY OF TITANIUM AND ITS ALLOYS [HELD AT] NEW YORK UNIVERSITY [ON] JUNE 27, 1952. June 27, 1952. 22p. (NP-4304)

NP-4310 1411
Georgia Inst. of Tech.
THE TRANSFERENCE OF HEAT BETWEEN A PIPE WALL AND A LIQUID-SOLID SUSPENSION FLOWING TURBULENTLY INSIDE THE PIPE. THE THERMAL CONDUCTIVITY AND VISCOSITY OF A LIQUID-SOLID SUSPENSION (thesis), by Clyde Orr, Jr. Dec. 1952. 160p. (NP-4310)

NP-4311 1417
Illinois Univ.
AN APPRAISAL OF THE PROT METHOD OF FATIGUE TESTING (PART I), by A. P. Boresi and T. J. Dolan. Jan. 1953. 33p. (NP-4311; Technical Report No. 34)

NP-4330 1439
Massachusetts Inst. of Tech.
THE MEASUREMENT OF SELF-DIFFUSION COEFFICIENTS BY AUTORADIOGRAPHY, by Harry C. Gatos and Ahmed Azzam. [nd] 8p. (NP-4330)

TEI-275 1427
Geological Survey
FURTHER STUDIES OF THE DISTRIBUTION OF URANIUM IN RICH PHOSPHATE BEDS OF THE PHOSPHORIA FORMATION, by M. E. Thompson. Nov. 1952. 25p. (TEI-275)

TEI-280 1428
Geological Survey
TRACE ELEMENTS RESEARCH QUARTERLY PROGRESS REPORT [FOR] APRIL 1 TO JUNE 30, 1952. [nd] 93p. (TEI-280)

USNRDL-372 1354
Naval Radiological Defense Lab.
DEPTH-DOSE MEASUREMENTS OF BETA-RAY ISOTOPES WITH PHOTOGRAPHIC FILM, by E. Tochilin and R. Golden. Aug. 12, 1952. 21p. (USNRDL-372)

WADC-TR-52-92 1421
Sintercast Corp. of America
INVESTIGATION OF INFILTRATED AND SINTERED TITANIUM CARBIDE, by C. G. Goetzel, J. B. Adamec, J. L. Ellis, and D. Trauberman. Apr. 1952. 52p. (WADC-TR-52-92)

NUCLEAR SCIENCE ABSTRACTS

Vol. 7 March 15, 1953 No. 5

GENERAL

ATOMIC BOMBS AND WARFARE

1315

Operations Analysis Div., Army Air Force

OPERATIONS ANALYSIS TECHNICAL MEMORANDUM NO. 25 [ON] BOMBING ACCURACY AND DAMAGE FROM ATOMIC BOMBS; AN INTRODUCTION, by Hugh J. Miser. Aug. 15, 1951. 41p. (NP-4296; Operations Analysis Tech. Memo. 25)

This memorandum presents a brief introduction to the relations between bombing accuracy and damage from atomic bombs, with primary emphasis on the underlying probability and statistical concepts. After discussing the relevant basic probability and statistical concepts and a geometric idealization of the problem of bombing targets with atomic bombs, the memorandum considers three problems: the problem of computing the probability that a point a distance D from the aiming point will receive a given amount of damage, the problem of computing the average proportion of a circular target that will receive a given amount of damage, and the problem of computing the probability that a circular target will be completely covered by a given damage circle. Tables are given which enable these three quantities to be computed in specific cases, and examples of the uses of these tables are given. (auth)

BIOLOGY AND MEDICINE

1316

Pennsylvania Univ. School of Medicine

LIGHT AND ELECTRON MICROSCOPIC STUDIES OF ESCHERICHIA COLI–COLIPHAGE INTERACTIONS. III. PERSISTENCE OF MITOCHONDRIA AND REDUCTASE ACTIVITY DURING INFECTION OF E. COLI B WITH T_2 PHAGE, by Philip E. Hartman, Stuart Mudd, James Hillier, and Ernst H. Beutner. Pennsylvania Univ. School of Medicine and RCA Labs. [Div., Radio Corp. of America.] [nd] 19p. (AECU-2333)

The activity of 2,3,5-triphenyltetrazolium reductase was found to remain at a constant level during the latent period of T2r phage infection of E. coli B growing in complex medium under essentially anaerobic conditions. Microscopic examination revealed that, while the nuclei were disrupted early in the latent period, the tetrazolium reductase activity of the mitochondria persisted in these discrete loci until lysis of the cells. (auth)

1317

Pennsylvania Univ. School of Medicine

A CYTOLOGICAL INVESTIGATION OF THE MITOCHONDRIA OF THREE STRAINS OF SALMONELLA, TYPHOSA, by John C. Davis, Loren C. Winterscheid, Philip E. Hartman, and Stuart Mudd. [nd] 23p. (AECU-2335)

Various supravital mitochondrial indicators have been used on three strains of S. typhosa. Some variation in the pattern of staining was noted, which demonstrates the existence of a gradient of mitochondrial reactivities. The mitochondria were differentiated from nuclei and cell wall, and showed no structural relationship to terminal flagellar spheres. (auth)

1318

Cancer Research Inst., New England Deaconess Hospital, Boston

ALBUMIN, ERYTHROCYTES AND ERYTHROCYTIC VIBRATIONS, by Edna H. Tompkins. [nd] 34p. (AECU-2336)

Characteristics of erythrocytes as observed with a phase microscope are described. Diameter measurements are compared with measurements made with light microscopes. Vibratory movement of the erythrocytes and the effects of saline washes and of the addition of serum or of crystalline bovine albumin to the washed suspensions of cells are described. (C.R.)

1319

Histochemical Lab., Cancer Research Inst., New England Deaconess Hospital, Boston

BASEMENT MEMBRANES IN CHRONIC INTESTINAL DISEASES, by Sheldon C. Sommers, Lilla M. Anderson, and Shields Warren. [nd] 7p. (AECU-2337)

Histochemical demonstrations of colonic basement membranes by the McManus and Mowry sulfuric acid hematoxylin method have failed to show a loss of these structures in cases of ulcerative colitis, cicatrizing enteritis, or diverticulitis, except locally in areas of inflammatory exudate or invasive cancer. Basement membrane degeneration did not characterize the colonic epithelium in chronic ulcerative colitis, using this method of examination. (auth)

1320

Biological Lab., Cold Spring Harbor

THE FREQUENCIES OF SUBVITALS IN EXPERIMENTAL POPULATIONS OF DROSOPHILA MELANOGASTER, by Bruce Wallace and Carol Madden. [nd] 24p. (AECU-2348)

A new technique is described for estimating sub- and supervitals in experimental populations of Drosophila. (C.R.)

1321

Atomic Energy Research Establishment, Harwell, Berks (England)

THE SPECTROGRAPHIC ESTIMATION OF TRACE ELEMENTS IN ANIMAL EYE LENSES, by M. L. Sizeland. Aug. 30, 1952. 12p. (AERE-C/R-1002)

A preliminary survey has been made of the occurrence of trace elements in animal eye lenses of the human, pig, and rabbit species. Normal, and in the human species also cataractous, lenses were analyzed spectrographically. The ashes of the lenses were examined for 32 elements. An accuracy of ±50% was obtained by visual comparison with prepared standards. No marked differences in the occurrence of trace elements were observed in the three species investigated. (auth)

1322

Brookhaven National Lab.

CAPILLARY AND CELLULAR PERMEABILITY TO SOME COMPOUNDS RELATED TO ANTIPYRINE, by Eugene M. Renkin. [nd] 20p. (BNL-1308)

The permeability of the capillaries in the isolated, blood-perfused hindlimb of the cat to a series of derivatives of 5-

pyrazolone, including antipyrine and aminopyrine, and to urea were studied by the method of osmotic transients. Observations are discussed in relation to the hypothesis that there are two routes by which molecules may penetrate the capillary endothelium: a system of discrete pores, penetration through which is restricted only by molecular dimensions, and the lipoid membranes of the endothelial cells, which provide an additional pathway for lipid-soluble molecules. The properties of the endothelial cell membranes are shown to be in accord with the well-known lipoid-film hypothesis of cell-membrane structure. (auth)

1323

Atomic Energy Project, Univ. of Rochester

AN IMPROVED DETERMINATION OF EXCHANGEABLE IONS IN BONE PREPARATIONS, by John H. Weikel, Jr. and William F. Neuman. Nov. 13, 1952. 14p. (UR-228)

A new apparatus modifying the method for the determination of the exchangeable ions of hydroxyl apatites or bone mineral is described. With the new technique, equilibrium conditions are obtained in a matter of hours and duplicate analyses are reproducible to 2.6%. This is an improvement of previously described methods which required several days for the attainment of steady-state conditions and were reproducible only to 6%. In addition, the new method provides means by which ionic exchange may be studied under controlled atmospheres. This will be of considerable help in studying the effects of the bicarbonate : carbonate system on the exchange of phosphate. (auth)

1324

CONCERNING THE PRESENCE OF CITRATE IN COMMERCIAL CRYSTALLIZED BOVINE SERUM ALBUMIN. Isaac Feldman and Jean R. Havill. Science 116, 691-2(1952) Dec. 19.

It has become a widespread custom to use Armour's crystallized bovine serum albumin, without pretreatment, as a representative protein in the study of the theory of ion-protein binding. It appears to be generally assumed that all but an insignificant amount of the citrate is removed by the crystallization process. However, during the course of an investigation of the binding of Be by albumin, it has been discovered that the commercial albumin preparation contains a significantly large amount of a strong complexing agent. Considering the relative binding strengths of the various possible contaminants, it is believed that this anion is citrate and is present to the extent of at least 0.5 moles/mole protein. (G.Y.)

1325

A TISSUE-TO-METAL ADHESIVE USEFUL IN GEIGER COUNTING. Herbert B. Locksley, Henry Powsner, and William H. Sweet. Science 116, 572-3(1952) Nov. 21.

A description is given of the use of commercial lecithin as an adhesive to keep thin blood and tissue samples stable when placed on counting planchettes and also to prevent flaking after heating. A thin layer is swabbed on the planchettes and allowed to dry to equilibrium with room air. The wet tissue is then weighed on the planchette and dried thoroughly by a hot plate. The tissue and lecithin form a tenacious bond that prevents the tissue from curling or flaking and keeps it closely adherent to the metal. (L.M.T.)

RADIATION EFFECTS

1326

Washington Univ., St. Louis, School of Medicine

ACTIVATION OF PSEUDOTUBERCULOSIS IN MICE EXPOSED TO SUBLETHAL TOTAL BODY RADIATION, by I. L. Shechmeister and F. L. Adler. [nd] 26p. (AECU-2350)

Mice subjected to sublethal doses of radiation developed generalized pseudotuberculous lesions resulting in a large number of deaths, while nonirradiated controls exposed to the infection either failed to contract it or developed subclinical pseudotuberculosis. Exposure of the subclinically infected animals to sublethal x irradiation resulted in an epidemic of the infection. The role of radiation in the activation of latent infections is discussed. (C.R.)

1327

Michigan Univ.

COLD STERILIZATION OF FOOD BY GAMMA RAYS, by L. E. Brownell, C. A. Lawrence, and J. T. Graikoski. [nd] 13p. (AECU-2355)

Experiments preliminary to a study of the industrial utilization of γ radiations from waste fission products for the cold sterilization of food are described. Photographs of the kilocurie Co^{60} γ source used for the studies are included. Data are presented on the effect of dosage of γ radiation on bacterial count, effects of γ radiation on various molds and viruses, and the effect of γ sterilization on the flavor of various foods. (C.R.)

1328

Argonne National Lab.

DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT FOR MAY, JUNE, JULY, 1952. Austin M. Brues, ed. [nd] 116p. (ANL-4840)

Separate abstracts have been prepared on two sections of this report.

1329

Argonne National Lab.

CHRONIC EXTERNAL IRRADIATION, NEUTRON RADIOBIOLOGY, HEMATOLOGY, PHYSIOLOGY, HISTOPATHOLOGY, AND RADIUM TOXICITY, p.10-56 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT FOR MAY, JUNE, JULY, 1952. Austin M. Brues, ed. [nd] 47p. (ANL-4840(p.10-56))

Progress is reported on the following studies: factors influencing irradiation treatment of experimental lymphoid tumors, modifications of acute irradiation injury by heterologous bone marrow injections in mice and guinea pigs, modification of acute irradiation injury by injection of tissues orginating from hematopoietic organs, the effects of total-body irradiation followed by bone marrow injections on leukemia in guinea pigs, septicemia in irradiated mice and its modification by bone marrow injection, tumor response to varying tumor and body doses of x irradiation, the effects of irradiation of mice with fast neutrons and γ rays, the effect of spleen shielding on the hematologic values of rabbits following total-body x irradiation, the temperature dependence of the protection of thymus cells by cysteine and anoxia, the effects of irradiation on mast cells, development of a technique for ultra-thin sectioning of tissues for electron microscopy, and clinical aspects of Ra toxicity. (C.R.)

1330

Argonne National Lab.

EXPERIMENTAL PATHOLOGY, SPECIAL PROBLEMS, INVERTEBRATE ZOOLOGY, MICROBIOLOGY, PHYTO-RADIOBIOLOGY, PHYSIOLOGICAL CHEMISTRY, ORGANIC CHEMISTRY, PHYSICAL CHEMISTRY, PHARMACOLOGY, THEORETICAL BIOLOGY, AND BIOPHYSICS, p.57-108 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT FOR MAY, JUNE, JULY, 1952. Austin M. Brues, ed. [nd] 52p. (ANL-4840(p.57-108))

Progress is reported on the following studies: the toxicity of Sr^{89} in mice, the fate and pathologic effects of Pu metal implanted into rabbits and rats, blood pressure changes in x-irradiated chicks, the effect of high-energy neutrons on metabolism in the egg nuclei of grasshopper nymphs, antibiotic and radiation sensitivity of auxin biosynthesis, the use of ethylenediamine as a carbonate-free alkali for CO_2 adsorption, the mechanisms involved in the reversal of toxicity

of Be, B, and U, the investigation of hormonal factors governing the response of rat liver triptophan peroxidase-oxidase to total-body x irradiation, a statistical estimation of the concentration of microorganisms using the dilution method, studies of the kinetics of population growth of microorganisms, the determination of photographic film exposure by neutron activation of Ag^{107}, a mathematical analysis of the growth of bacterial colonies, incorporation of Gd into liquid scintillators for increasing sensitivity to thermal neutrons, the possibilities and limitations of fluorescent x-ray analysis by means of proportional counters, and a study of the mechanisms operating in the ionization-type halide detector. (C.R.)

1331

Air Force Radiation Lab., Univ. of Chicago
QUARTERLY PROGRESS REPORT NO. 5. Oct. 15, 1952. 82p. (NP-4247; Quarterly Progress Report No. 5)

Separate abstracts have been prepared on two sections of this report.

1332

Air Force Radiation Lab., Univ. of Chicago
[Pages 1-17 of] QUARTERLY PROGRESS REPORT NO. 5. Oct. 15, 1952. 17p. (NP-4247(p.1-17))

In an attempt to establish a convenient biochemical dosimeter of ionizing radiation in man it was shown that blood cell carboxypeptidase inhibitor (CPI) is reduced at a dose level in the range of the LD_{50} for man, and also in the presence of malignant growth and certain other pathological conditions. Preliminary work on carboxypeptidase reduction by various doses of whole-body x irradiation in rats is reviewed and additional data on guinea pig blood are presented in tabular form. A description is given of the rationale for, and the attempts to demonstrate, the use of species-homologous catalase as a protective agent against x-radiation lethality. A new highly sensitive color test for H_2O_2 is described. Negative results were obtained in attempts to demonstrate H_2O_2 in tissue homogenates of irradiated mice by means of this test. No x-ray activation of nucleotidase was demonstrated in rats. The possible destruction of a blood-borne inhibitor of carboxypeptidase as the mechanism by which this enzyme is increased in activity in kidney after whole-body x irradiation is discussed and additional data from studies on rats are included. Results of carboxypeptidase inhibitor assays on the blood of 328 patients are reported. Low assays were obtained in a large percentage of patients with malignant disease and in patients with liver disease, granulomatous diseases, and diabetes. The possible application of this test as a biological indicator for ionizing radiation dosage is discussed. (C.R.)

1333

Air Force Radiation Lab., Univ. of Chicago
[Pages 18-82 of] QUARTERLY PROGRESS REPORT NO. 5. Oct. 15, 1952. 65p. (NP-4247(p.18-82))

In a study of the influence of hematopoietic tissues on intermediary carbohydrate metabolism experiments using thymus gland homogenates and bone marrow homogenates demonstrated that both of these tissues have the ability to stimulate the oxygen consumption of liver homogenates. Spleen homogenates were shown to inhibit oxidative phosphorylation by liver tissue during the oxidation of pyruvate plus fumarate. Preliminary data from studies on rats indicate that the drugs which are commonly used as central nervous system stimulants by man will have no appreciable effect on susceptibility to radiation. Data from studies of the effects of x irradiation on the 5-nucleotidase and adenosine triphosphatase activities of tissues from rats and ground squirrels are included. The recovery of rate of reproduction of amoeba exposed to various levels of x irradiation was some 50% faster when nonirradiated $\frac{1}{3}$ cell portions of normal amoeba were fused with the whole, x-irradiated amoeba. Possible reasons for the accelerated recovery are discussed. Both p-aminopropiophenone (PAPP) and sodium nitrite were found to decrease x irradiation mortality in amoeba when given prophylactically. Effects on growth and survival and a possible site of action for PAPP and $NaNO_2$ are discussed. Preliminary investigations indicate that the prior administration of polyethylene glycol 200 (mono) laurate and polyethylene glycol 200 (mono) oleate to mice significantly increase the survival after exposure to 800r x radiation. Dogs exposed to 100 r total-body unfiltered x radiation responded by a depression of the hematocrit readings, and of the serum K and Na concentrations during the first hour after exposure. Rats exposed to 100 r or 1000 r did not show these changes. Preliminary studies show a positive relation between histamine sensitivity and x radiation sensitivity in mice. (C.R.)

1334

Atomic Energy Project, Univ. of Rochester
QUARTERLY TECHNICAL REPORT [FOR] JULY 1, 1952 THRU SEPTEMBER 30, 1952. Nov. 3, 1952. 57p. (UR-222)

In a study of the effects of radiation on the reticulo-endothelial system no effect was produced by an LD_{50} dose of total-body x radiation on the response of rabbits to intravenously injected pyrogenic material as measured by their febrile response. The relationship of the reticulo-endothelial system to this tolerance is briefly discussed. A study indicates no detrimental effects of whole-blood transfusions to dogs receiving nonlethal doses of x radiation. Dogs receiving an LD_{80} dose of total-body x radiation showed no benefits from daily blood transfusions given for 5 days post irradiation. Observations made on irradiated and non-treated dogs and on one human patient indicate that Piromen (a non-protein bacterial component believed to stimulate the reticulo-endothelial system) is capable of increasing the phagocytic activity of leukocytes. The formula, procedure, and staining results for a new, improved, differential morphology stain for spermatozoa are given. In a study of flash burns it was found that removal of the ultraviolet portion of radiant energy emitted by a carbon-arc source produced burns of less surface severity but approximately the same in depth of damage. The reaction is briefly discussed. Abstracts of seven papers presented at meetings during the quarter are included. (C.R.)

1335

BIOLOGICAL INTERFERENCES BETWEEN X RAYS AND CERTAIN RADIOISOTOPES. J. Maisin and G. Lambert. J. belge radiol. 35, 329-36(1952). (In French)

In order to investigate the development of an adaptation syndrome in irradiated rats, the authors have determined the curves of mortality resulting from 500-r whole-body x-ray exposure subsequent to partial or whole-body, single or repeated external x irradiation or single or repeated internal injections of Na^{24} or Co^{60}. Neither whole-body nor spleen irradiations gave significant protection against a lethal dose of x rays. Small doses of radioisotopes, but not large doses, injected prior to lethal irradiation resulted in survival curves consistently and significantly above those for controls. (G.Y.)

1336

CYTOLOGICAL VARIATIONS OF NORMAL VAGINAL EPITHELIUM AND NEOPLASTIC TISSUES OF THE CERVIX UNDER THE INFLUENCE OF RADIUM THERAPY. André Ghilain and W. F. Bouwer. Gynecol. et obstet. 51, 309-23(1952). (In French)

Detailed descriptions and microphotographs are presented of changes in various vaginal and neoplasm cells during the course of Ra therapy of epitheliomas and adeno-

carcinomas in 19 patients. Evaluation of the cellular radiosensitivity is discussed. 26 figures. (G.Y.)

1337

MECHANISM OF X-RAY EFFECTS ON REFLEX EXCITABILITY. Ya. I. Geĭnisman and E. A. Zhirmunskaya. Fiziol. Zhur. S.S.S.R. 38, 312-18(1952) May-June. (In Russian)

Investigation of the acid reflex of frogs showed that whole-body irradiation with 7000 r of x rays reduced the reflex excitability. Study of the potentials of sensory skin nerves showed that, depending on its intensity, excitation of the skin of the irradiated frogs produced a weaker response of receptors, characterized by a smaller number of pulses. Partial x irradiation of the region of the sympathetic nervous system (in special surviving preparations) with 5400 r induced changes in the electrical activity of skin receptors. The character and direction of these changes depended on the state of excitation of the receptors before the irradiation. The depression of the acid reflex and diminution of the electrical activity of skin receptors appeared immediately after irradiation. This requires reexamination of existing ideas on the duration of the latent period for x-ray effects and evidence concerning a reflex mechanism for these effects. (tr-auth)

1338

EFFECTS OF BETA-RADIATING ISOTOPES IN FRUIT TREES. Lars Ehrenberg and Ingvar Granhall. Hereditas 38, 385-419(1952)

For the purpose of obtaining high β-radiation doses in the sensitive vegetation points of young fruit trees different methods of introducing P^{32} and S^{35}, given as phosphate or sulfate, respectively, into the trees have been compared. Injection with small volumes of concentrated isotope solutions into not only stems and branches but also individual buds or bud bases by the aid of a micrometer syringe after the start of sprouting in the spring has turned out to be a convenient method. The spreading and distribution of the isotopes in different parts of the trees have been determined through direct analysis or autoradiographs. An accumulation, especially of P^{32}, to meristematical regions is observed. A method for the determination of tissue doses has been worked out. Doses high enough to cause lethality in individual buds are easily obtained, in any case with P^{32}. The frequencies per unity dose of the primary biological effects studied (shoot bifurcations and leaf deformations) seem to decrease in the order neutrons > x rays > P^{32} β rays. Probably these differences depend upon the ionization densities of the radiations. In this connection a case of regularly changed leaf shape in roses after P^{32} treatment is described. It is concluded that the radioisotopes will be valuable in mutation work with fruit trees. (auth)

1339

CHEMICAL AND BIOLOGICAL EFFECTS OF NEUTRONS AND X-RAYS. Lars Ehrenberg and Nils Nybom. Hereditas 38, 481-501(1952)

Tissue doses of ionizing radiations in embryos of barley seeds have been determined with a chemical dosimetry, involving an indicator reaction occurring in a solution of the same atomic composition as the tissue. On the basis of the chemical dosimetry developed it can be stated that fast neutrons are at least 20 times more effective than x rays as regards the production of lethality, growth retardation, chromosomal rearrangements, sterility, and gene mutation, consequent upon the irradiation of dormant or germinating seeds of barley. (auth)

1340

THE EFFECTS OF RADIATION ON THE CHICK EMBRYO. Frank J. Dixon. Ann. N.Y. Acad. Sci. 55, 216-20(1952).

A background of the general effects of radiation on the chick embryo includes data on x-radiation lethal doses for different age embryos (2 to 18 days) and the effects of intrayolk injections of P^{32} at different days of incubation. In the case of the x radiation the embryo seems to become more vulnerable to radiation as age increases. From the P^{32} experiments it is observed that the embryo can tolerate greater amounts of radiation when given at extremely slow rates. After the general effects of radiation are presented, specific radiation-induced morphologic changes from injection of P^{32} are considered. The effects on overall growth rate, gonads, bone marrow, peripheral blood, and lymphoid tissue are discussed. (L.M.T.)

1341

EFFECT OF IRRADIATION ON LYMPHOID TISSUE NUCLEIC ACIDS IN C57BL MICE. Patricia P. Weymouth and Henry S. Kaplan. Cancer Research 12, 680-3(1952).

It was found that desoxyribonucleic acid phosphorus (DNAP) concentration increased with age in thymus and lymph nodes of normal C57BL mice, reaching a maximum at 90 days and decreasing thereafter. The concentration of P in the fraction (RP) containing ribonucleic acid did not change appreciably with age and was the same in thymus and lymph nodes. In C57BL mice x-irradiated systemically with four doses of 168 r at 8-day intervals, thymic concentration of DNAP decreased 40% 4 days after treatment and remained significantly reduced through 142 days, at which time most of the thymuses were involved by lymphomas. In contrast, lymph-node DNAP concentration, although depressed immediately after irradiation, returned to normal by 117 days after treatment. (auth)

1342

RADON IMPLANTATION IN THE MEDULLA OBLONGATA OF THE DOG: EFFECTS ON THE DEGREE AND EXTENT OF CELLULAR REACTIONS. Joseph H. Globus, S. C. Wang, and H. I. Maibach. J. Neuropathol. Expti. Neurol. 11, 429-42(1952) Oct.

Neurohistological changes resulting from the implantation of Rn seeds in the medulla oblongata of the dog are described. (auth)

1343

THE IRRADIATION OF DRIED HEMOGLOBINS BY FAST CHARGED PARTICLES. II. R. K. Appleyard. Arch. Biochem. and Biophys. 40, 111-26(1952) Sept.

The detailed investigation of the behavior of dried carboxyhemoglobins under irradiation by fast charged particles has been continued by a variety of methods, including electron irradiation, antigenic studies, pH effects, and the spectrophotometry of dried protein films. It is shown that simultaneous radiation events may potentiate each other. This does not occur if they are separated in time. Evidence is presented showing the existence of intermediate states in which molecules are weakened by the radiation but not destroyed. Such weakened molecules may remain soluble at neutral pH. They show the same antigenic behavior and the same mobility in the ultracentrifuge as unirradiated molecules. The hypothesis is developed that solvent action plays a large part in effects observed after dried irradiated material has been redissolved. Further evidence is presented that the principal effect observed spectrophotometrically is insolubility of the whole protein. It is shown that when solubility considerations are eliminated the optical absorption is very insensitive to radiation action, which suggests that the individual groups responsible are only directly destroyed by radiation with a high probability when a primary ionizing event occurs very close to them. (auth)

1344

INFLUENCE OF CYSTEINE ASSOCIATED WITH ASCORBIC ACID ON RADIATION-INDUCED VARIATIONS IN THE PLASMA PROTEIN FRACTIONS. Enrico Caffaratti. Radioterapia radiobiol. e fis. med. 8, 144-52(1952). (In Italian)

Male guinea pigs of 450 g weight were injected intramuscularly with 750 mg of cysteine and 150 mg of ascorbic acid, then were whole-body irradiated with 800 r of 180-kv x rays. Variations in albumin and globulin fractions and total protein with respect to injected or irradiated controls were determined. A reduction in the post-irradiation percentage increase of γ globulin was noted. (G.Y.)

1345

STUDIES ON THE SECOND LINKAGE GROUP IN THE SILKWORM, BOMBYX MORI L. II. PALE STRIPED (P^{st}) AND SECOND STRIPED (S^2) INDUCED BY X-RAYS. Tsuneo Takasaki. Bull. Sericult. Expt. Sta. (Tokyo) 14, 10-21(1952) Apr. (In Japanese)

Two mutants of larval marking pale striped (p^{st}) and second striped (S^2) were found in the F_1 of the crossing of a $p^s Y$ + /p + Oa female with a p + ^{Y}Oa male, the female having been treated with x rays 7 to 8 days after pupation. The mutants and their genetic origin are described in detail. A lengthy English summary presents all significant data. (G.Y.)

1346

COMPARATIVE INVESTIGATIONS ON THE PRIMARY EFFECT FOLLOWING ACTION OF FAST ELECTRONS AND X RAYS ON TISSUE CULTURES. Henni Gärtner. Strahlentherapie 89, 26-51(1952). (In German)

After irradiation of cultures of chicken heart fibroblasts with individual 500- and 4000-r doses of fast electrons from a 6-Mev betatron or with 90-kv x rays, quantitative and qualitative differences in the effects produced by these two types of radiation can be determined during the course of the primary effect. The cause might be seen in the different density of ionization of these two radiations. (auth)

1347

AN AFTER-EFFECT IN BUTTER-FAT IRRADIATED WITH HIGH-ENERGY ELECTRONS. R. S. Hannan and H. J. Shepherd. Nature 170, 1021-2(1952) Dec. 13.

Butterfat was irradiated with 1.2-Mev electrons at temperatures from −70 to +37°C and stored for periods up to 8 days at −70 to +20°C. A maximum rate of increase in peroxide value was noted at −20°C. Formation by the radiation of a reactive intermediate compound stable at very low temperatures but rapidly deactivated at room temperature or higher is indicated. A partial destruction of the small amounts of antioxidants (mainly tocopherols) present in the fat also occurs during and after irradiation. (G.Y.)

RADIATION HAZARDS AND PROTECTION

1348

Oak Ridge National Lab.

EXTERNAL AND INTERNAL EXPOSURE TO IONIZING RADIATION AND MAXIMUM PERMISSIBLE CONCENTRATION (MPC) OF RADIOACTIVE CONTAMINATION IN AIR AND WATER FOLLOWING AN ATOMIC EXPLOSION, by K. Z. Morgan and C. P. Straub. Apr. 4, 1952. 17p. (AECU-2332)

If an atomic bomb is exploded at sufficient elevation to take full advantage of blast and thermal effects, there ordinarily will not be an appreciable amount of surface radioactive contamination. In case of an underwater or underground explosion the total curies of fission products per kilogram of U or Pu fissioned at any time, t, in seconds after the explosion is given approximately by the equation $C_\beta = 2.7 \times 10^{13}\ t^{-1}$. In addition there would be a small fraction of the contamination due to induced activity and fissile material from the bomb. If a person entered a contaminated area at t_0 hours after the atomic explosion where the dose rate was R_0 reps/hr and remained until t_1 hours after the explosion, the approximate total dose, D, in reps from external exposure is given by the equation $D = 2.3\ R_0\ t_0 \log_{10}(t_1/t_0)$. It is estimated that the emergency values of MPC of the radioisotopes in μc/cc is given approximately by the equation $MPC = K\ t^{-1.2}$ for the time interval from 30 min to 3 yr following the explosion. If time, t, is given in days, $K = 10^{-3}$ for drinking water contaminated with any expected contaminant emitting α, β, or γ radiation. In case of contaminated air $K = 10^{-7}$ for β-or γ-emitting radioisotopes or 5×10^{-10} for α-emitting radioisotopes. (auth)

1349

Chemical and Radiological Labs., Army Chemical Center

MAXIMUM ALLOWABLE CONCENTRATIONS OF FISSION PRODUCTS IN THE AIR AS A FUNCTION OF EXPOSURE TIME AND TIME AFTER DETONATION (Continued), by Robert L. Harvey. Jan. 16, 1952. 11p. (CRLIR-81)

In a previous report, CRLIR 64, the internal hazard resulting from airborne concentrations of fission products was evaluated in terms of an equivalent Sr^{90} hazard, and a graph was drawn showing the maximum permissible fission product concentrations for three periods of exposure at 1 hr to 1 yr after detonation. In this paper, some of the assumptions have been modified, the calculations have been refined, and the presence of Pu is considered. A new graph has been prepared showing maximum permissible concentrations up to 50 times greater. In effect this report supersedes CRLIR 64. (auth)

1350

PRECAUTIONS IN AUTOPSY AND EMBALMING PROCEDURES FOLLOWING THE ADMINISTRATION OF RADIOISOTOPES. Hosp. Management 74, 96-98(1952) Dec.

Instructions compiled by the Armed Forces Institute of Pathology, Washington, D. C., with the approval of the Division of Biology and Medicine of the AEC, for precautions to be taken during autopsy and embalming procedures following the administration of radioisotopes to patients are outlined. (C.R.)

1351

THE EFFECT OF FAT LEVEL OF THE DIET ON GENERAL NUTRITION. IX. THE RELATIONSHIP OF RADIATION INJURY IN THE RAT TO THE FAT CONTENT OF THE DIET. Amber L. S. Cheng, George D. Kryder, Lois Bergquist, and Harry J. Deuel, Jr. J. Nutrition 48, 161-82 (1952) Oct.

No differences were noted in the susceptibility of rats to x-irradiation injury as related to the fat content of the diet when the animals (on the diets for 3 to 4 weeks) were subjected to 650 or 850 r in a single dose. On the other hand, when rats (on the diets for 12 weeks) were treated with a series of sublethal doses of x irradiation at weekly intervals (2400 r over 10 or 14 weeks in 300 r doses), the rats receiving fat in their diets were found to be more resistant and survived over a longer interval than did those on the fat-free regimen. (auth)

1352

MODE OF ACTION OF AGENTS GIVING PROTECTION FROM RADIATION. P. Alexander and M. Fox. Nature 170, 1022-3 (1952) Dec. 13.

X rays degrade polymethacrylic acid in aerated aqueous solutions; the extent of the reaction can readily be followed by changes in viscosity with a high-molecular-weight sample of the polymer. The degradation is reduced in the presence of substances which are protective agents in biological experiments. The perhydroxyl radical, HO_2, known to be formed by x rays in the presence of oxygen, seems to be the most probable agent responsible for the degradation observed. H_2O_2, another product of irradiation, does not by itself react with the polymer even in high concentrations. Some of the compounds giving protection against radiation

do not react with hydroxyl radicals, whereas all react with the radical responsible for the degradation. It is suggested that these substances protect against radiations in vivo by competitively removing perhydroxyl radicals formed in the presence of oxygen. Allyl thiourea, which does not appear to have been examined biologically, was found to be a highly effective protective agent. (G.Y.)

RADIOGRAPHY

1353

OBSERVATIONS ON THE OVARIES AND VAGINA OF MICE WITH STRIPPING FILM AUTORADIOGRAPHY. U. Aminoff, G. Magnusson, and E. Odeblad. Nord. Med. 48, 1123-4(1952) Aug. 15. (In Norwegian)

A short review is given of Doniach and Pelc's stripping-film technique, and a modification of their method is described, allowing separation of film and section. Using these two methods on adult female mice, injected with P^{32} as orthophosphate, the authors have succeeded in observing intracellular accumulation of radioactive phosphorus in the egg cell, probably localized to the nuclear membrane. A high content of P^{32} was also observed in the basal layer of the vaginal epithelium. Towards the surface the amount of P^{32} decreased, so that the cornified membrane contained no detectable amounts of the radioisotope. (auth)

RADIOTHERAPY

1354

Naval Radiological Defense Lab.

DEPTH-DOSE MEASUREMENTS OF BETA-RAY ISOTOPES WITH PHOTOGRAPHIC FILM, by E. Tochilin and R. Golden. Aug. 12, 1952. 21p. (USNRDL-372)

The response of seven photographic emulsions to β rays has been investigated using β-ray isotopes ranging in maximum energy from 0.5 to 3.55 Mev. Depth-dose curves of three β-ray isotopes used as medical applicators were obtained with photographic film and compared to extrapolation chamber measurements of the same sources. (auth)

1355

DIAGNOSTIC AND THERAPEUTIC APPLICATION OF RADIOIODINE I^{131}. W. Horst. Fortschr. Gebiete Röntgenstrahlen 77, 567-78(1952) Nov. (In German)

A two-phase test using I^{131} is described. This permits a diagnosis of the thyroid gland to be made which can not be equaled in form and accuracy by any other method, not even by designation of the basal metabolism. The diagnosis of location renders possible an atomic and topic, as well as a pathologic-anatomic diagnosis in vivo. The treatment of hyperfunction of the thyroid gland with I^{131} corresponds with the surgical results of 92%. Contrary to the surgical treatment there is no handicap of a primary mortality. The treatment of the metastasizing neoplasms of the thyroid gland with I^{131} has a good result in 7 to 15% of the cases. These numbers are comparable, for instance, with the surgical results in carcinoma of the stomach. (auth)

1356

SENSITIZATION OF MALIGN TUMORS BY SHORT WAVES. Georg Fuchs. Strahlentherapie 88, 647-53(1952). (In German)

Evidence is accumulating for the possibility of sensitizing malignancies to x rays by means of short waves. According to the author's method a preliminary short-wave (6 m) treatment of between 10 and 15 min is applied to the tumor and x rays are given immediately afterwards. The increase in the sensitivity is ascribed to hyperemia and accelerated metabolism, yet activation of connective tissues is equally feasible. The method appears particularly successful in cases of intrathoracal tumors and local recurrences of cancer of the breast, as is exemplified by several observations. No hazards are taken by combining short waves with x rays provided the correct method is instituted. (auth)

1357

RADIOACTIVE STRONTIUM THERAPY OF THE EYE. CORNEAL BIOSTANDARDIZATION AND EVALUATION OF AN APPLICATOR FOR USE IN OPHTHALMOLOGY. Fred M. Wilson and John W. Wilson. Arch. Ophthalmol. (Chicago) 48, 686-95(1952) Dec.

An evaluation was made of β applicators, in which Sr^{90} was used as the radiation source, in terms of some of the isotope's radiobiological effects on the rabbit cornea. It was concluded that Sr^{90} offers promise as a source of radiation for use in ophthalmology. (C.R.)

1358

THERAPEUTIC TRIALS OF RADIOGALLIUM (Ga^{72}); A REPORT OF FOUR CASES. E. R. King, L. W. Brady, and H. C. Dudley. Arch. Internal Med. 90, 785-9(1952) Dec.

The clinical courses of therapeutic trials of Ga^{72} in four cases of incurable bone cancer are presented. The clinical results are indefinite so far as positive beneficial results are concerned. Stable-gallium toxicity limits the amount of the radioactive Ga that can be administered. Consequently, Ga^{72} is not considered to be an effective therapeutic agent. (auth)

1359

RANGE AND IONIZATION DENSITY OF ELECTRONS PRODUCED BY X RAYS. F. Wachsmann. Strahlentherapie 89, 128-36(1952). (In German)

The author describes an ionization chamber that can be adjusted to different depths and that permits measurement of the medium range of electrons librated in the tissue (bone). The values found in the experiment correspond to those given by Lea (Actions of Radiation on Living Cells, Cambridge, 1946) in that, within the voltage range of 20 to 200 kv applied to the tube, the velocity of the electrons was always practically the same. The values measured for the range of the electrons are, however, lower (by the factor 3 to 5) than those calculated. This can be explained by geometry and by the fact that the detour factor was not sufficiently taken into account. The following explanation proves that the term "average density of ionization," so important for biological effectiveness, may be defined in different ways, according to whether reference is made to the specific primary ionization along an electron path or to the density of integral ionization. The density of integral ionization proper may be calculated by integration over the length of an electron path or by the energy. The figures resulting from the different definitions are compared and discussed as to which one of the given definitions is most likely to be employed for practical therapy. (auth)

TOXICOLOGY STUDIES

1360

BERYLLIOSIS: SUMMARY AND SURVEY OF ALL CLINICAL TYPES IN TEN YEAR PERIOD. Joseph M. DeNardi, H. S. Van Ordstrand, and George H. Curtis. Cleveland Clinic Quart. 19, 171-93(1952).

During the period 1940 to 1952 a total of 431 patients with various manifestations of acute Be intoxication were observed and treated. Clinical and laboratory data were obtained on more than 75 cases of recovered tracheobronchitis and pneumonitis; detailed tabulation is presented in 20 cases in each group. Thirty cases of the chronic dermal and pulmonary forms of berylliosis have been observed and treated, with eight resultant deaths. Exposure factors, urine analyses for Be, and other pertinent data are recorded for this group,

plus tissue analyses for the element in five autopsied cases. Significant data are presented of Be findings in the necropsied tissue of two patients who recovered from major acute respiratory manifestations, but died later from other causes years after removal from exposure. Of the eight instances of chronic berylliosis of occupational origin, one patient had a medically established diagnosis of acute tracheobronchitis, while four others gave histories suggestive of acute tracheobronchitis during brief occupational exposures to Be. (auth)

1361

RELATIVE TOXICITY OF LANTHANUM, TANTALUM, AND THORIUM COMPOUNDS IN THE DEVELOPING CHICK EMBRYO. L. J. Machlin, P. B. Pearson, and C. A. Denton. Arch. Ind. Hyg. Occupational Med. 6, 441-4(1952) Nov.

These studies indicated that La chloride, Th chloride, and Ta hydroxide were not highly toxic to the developing chick embryo. The LD_{50} values were as follows: La chloride, 14 mg per egg; Th chloride, 46 mg per egg; and Ta hydroxide, 44 mg per egg. The toxicity of La chloride and Th chloride for the developing chick embryo is of the same order of magnitude as for the growing rat when administered intraperitoneally. Hemorrhage was the most prevalent sympton found among dead embryos. A stiff hock joint syndrome is described. The incidence of this abnormality in the developing embryo appears to be exaggerated by injections of the Th and Ta compounds. (auth)

1362

BAL THERAPY IN CHRONIC LEAD POISONING. Rudolph C. Giannattasio, Michael J. Pirozzi, Andrew V. Bedo, and Kenneth G. Jennings. Pediatrics 10, 603-11(1952) Nov.

Three cases of chronic lead intoxication have been presented which were treated with BAL in a dose of 4 mg/kg body weight every four hours for 20 days. Cessation of symptoms were noted in every case. Resting urinary lead levels were increased three to sevenfold without exacerbation of symptoms of plumbism. BAL was found to be nontoxic in the dose used and acted as an effective deleading agent. The authors feel that this form of treatment merits use in both the chronic and acute phases of lead intoxication. (auth)

1363

THE DISTRIBUTION AND EXCRETION OF THORIUM SULPHATE. J. K. Scott, W. F. Neuman, and J. F. Bonner. J. Pharmacol. Exptl. Therap. 106, 286-90(1952) Nov.

When a soluble thorium compound was administered intravenously to animals it was removed from the blood slowly and most of the thorium was found in the liver, spleen, and bone marrow. Following intramuscular injection thorium remained in the injected muscle and following intratracheal injection it remained in the lung. When the compound was given by gavage it was recovered in the feces and no absorption could be demonstrated by the procedures used. (auth)

TRACER APPLICATIONS

1364

California Univ., Davis, School of Veterinary Medicine

THE MOBILITY OF SKELETAL PHOSPHORUS IN A MATURE DAIRY COW AS DETERMINED WITH RADIOACTIVE PHOSPHORUS, by A. L. Black, M. Kleiber, A. H. Smith, and N. P. Ralston. California Univ., Davis, School of Veterinary Medicine and California Univ., Davis, Coll. of Agriculture. [nd] 11p. (AECU-2334)

P^{32} was injected intravenously to measure the "labile" P pool in the skeleton of a mature, lactating dairy cow. This pool contains about 1% of the total skeletal P which was 15 times as large as the total circulating P pool in the plasma. Autoradiograms and radioassays indicated that this labile pool extended throughout the skeleton but that its distribution was determined by the type of bone involved. Cortical bone contains only one-third as much P in the labile state as does trabecular bone. About 12% of the injected P^{32} was present in the skeleton at the time of slaughter of the animal, 3 days after the injection. (auth)

1365

Institute for Cancer Research, Philadelphia

BIOSYNTHETIC PATHWAYS. III. THE BIOSYNTHESIS OF LYSINE BY TORULOPSIS UTILIS, by Murray Strassman and Sidney Weinhouse. Institute for Cancer Research, Philadelphia and Lankenau Hospital Research Inst., Philadelphia and Temple Univ. [nd] 20p. (AECU-2345)

Lysine isolated from yeast grown in glucose in the presence of tracer amounts of methyl- and carboxyl-labeled acetate had a distribution of activity which indicated that its carbon chain is built up through a combination of acetate with the succinate moiety of α-ketoglutarate. Similar experiments with methylene- and carboxyl-labeled glycine, carboxyl-labeled lactate, and formate are in accord with this assumption. Two possible mechanisms are suggested for the formation of the lysine carbon chain. (auth)

1366

California Univ., Davis, Coll. of Agriculture

PROPIONATE AS A PRECURSOR OF MILK CONSTITUENTS IN THE INTACT DAIRY COW, by Max Kleiber, Arthur L. Black, Mary A. Brown, and Bert M. Tolbert. California Univ., Davis, Coll. of Agriculture and Radiation Lab., Univ. of Calif., Berkeley. [nd] 17p. (AECU-2361)

Intact normal dairy cows were injected with carboxyl and with methyl C^{14}-labeled Na propionate in doses ranging from 9 to 12 μc/kg body weight. Data are presented on the C^{14} content of respiratory CO_2 and the C^{14} content and specific activity in lactose, casein, and butterfat at various times post injection, the influence of the position of the label on the average level of C^{14} in expired CO_2, and the pathway of C^{14} from the methyl group and from the carboxyl group into lactose, casein, and butterfat. (C.R.)

1367

Brookhaven National Lab.

CHLORIDE, BROMIDE, SODIUM, AND SUCROSE SPACES IN HUMANS, by James L. Gamble, Jr., James S. Robertson, Charles A. Hannigan, Charles G. Foster, and Lee E. Farr. [nd] 24p. (BNL-1326)

The volumes of distribution of Cl^{38}, Na^{24}, stable bromide, and sucrose were determined simultaneously in five patients. The volumes of distribution of Cl^{38} and Br^{82} were determined simultaneously in 10 patients. Using average values obtained 2.5 hr after injection and setting the volume of distribution of chloride at unity, the relative values obtained with the other agents were 1.07 for Na, 1.07 for stable bromide, 1.02 for radioactive bromide, and 0.77 for sucrose. (auth)

1368

Atomic Energy Project, Univ. of Rochester

THE SURFACE CHEMISTRY OF BONE: VII. THE HYDRATION LAYER, by W. F. Neuman, T. Y. Toribara, and B. J. Mulryan. Nov. 18, 1952. 23p. (UR-230)

Three kinds of evidence have been obtained which demonstrate that the crystals of hydroxyl apatite and bone are highly hydrated. The water is not removed by high-speed centrifugation, the water layer does not contain the electrolytes of the bulk solution, and the crystals adsorb water vapor in accordance with the Brunauer, Emett, and Teller theory. It has been shown that adult, compact shaft contains little, if any, water other than that present as water of hydration. The significance of these findings is discussed. (see UR-184) (auth)

1369

A COMBUSTION TECHNIQUE FOR THE ASSAY OF TRITIUM, ^{13}C AND ^{14}C IN A SINGLE 10 MG. SAMPLE OF

BIOLOGICAL MATERIAL. R. F. Glascock. Biochem J. 52, 699-704(1952) Dec.

A rapid method is described for the quantitative combustion of 10 mg samples of biological materials. Methods for the assay of tritium as tritiobutane and C^{14} as $C^{14}O_2$ on this scale are briefly summarized, and methods of measuring and counting 10μl to 10 ml samples of radioactive gases are described. Results are presented which demonstrate the quantitative combustion of some standard substances. The closely agreeing results of combusting and assaying in triplicate a sample containing the three isotopes are also presented. The various methods of assaying the three isotopes are discussed with special reference to C^{14}. The conclusions are drawn that gas counting is preferable for tritium especially at low activities and in the presence of C^{14}; that the counting of solid samples containing C^{14} is most reliable if first reduced to a single standard compound (usually $BaCO_3$) and that gas counting is simpler than this and more efficient by at least a factor of 10, thus allowing a tenfold reduction in the dose of isotope used in biological experiments. (auth)

1370

RADIOCONTAMINANTS IN BIOLOGICAL STUDIES WITH COPPER-64. W. Joe Frierson, Sam L. Hood, Ira B. Whitney, and C. L. Comar. Arch. Biochem and Biophys. 38, 397-404(1952) July

In tracer Cu studies the radioactivity in the urine of animals had a longer half life than the original Cu^{64}, indicating the presence and concentration of other radioactive nuclides. Paper chromatography and chemical fractionations of solutions of the irradiated Cu unit separated and identified two major radiochemical impurities, Zn^{65} and Ag^{110}, and indicated the presence of Zn^{69}, Fe^{59}, and possibly others. The type and concentration of contaminants is variable. Electrolytic purification of the Cu is feasible. The presence of radiocontaminants at the observed levels is of importance in activity measurement when there is chemical or biological concentration of the impurity relative to the nuclide being studied or when the principal nuclide has a shorter half life so that the impurity contributes relatively more as time passes. (auth)

1371

KINETICS OF RADIOPOTASSIUM IN THE CIRCULATION. W. Gordon Walker and Walter S. Wilde. Am. J. Physiol. 170, 401-13(1952) Aug.

The kinetics of the exchange of K into and out of the circulation was studied by rapid injection of 0.5 ml $K^{42}Cl$ into the ear veins of rabbits. After an initial circulatory mixing wave, plasma radioactivity P begins to fit the equation $P = P_1e^{-\lambda_1 t} + P_2e^{-\lambda_2 t} + P_{ne}{}^{-\lambda n t} + Peq$ but, after initial decline, $P_1e^{-\lambda_1 t}$ is so precipitous that 90% of the circulating tag is removed the first minute. Therefore the new equation of Sheppard and Sangren (Federation Proc. (1) 2, 147(1952)), based on the assumption that the flux of the tag is entirely outward, was used. It appears that the fraction of K^{42} removed from the circulation per minute is equal to the fraction of plasma volume pumped through the heart, since the plasma concentration of tag declined at the same rate in eviscerate animals as in normals. The results indicate a passive exchange or diffusion mechanism for the transfer, but active transfer is not entirely excluded. 25 references. (L.M.T.)

CHEMISTRY

1372

Atomic Energy Research Establishment, Harwell, Berks (England)

THE SYSTEM BORON TRIFLUORIDE–METHANOL, by N. N. Greenwood. Aug. 11, 1952. 27p. (AERE-C/R-990)

Specific electrical conductivity–composition isotherms in the system boron trifluoride–methanol indicate the existence of a 1:1 and a 1:2 complex. The monomethanol, $BF_3{\cdot}CH_3OH$, and dimethanol, $BF_3{\cdot}2CH_3OH$, have been obtained as colorless crystalline solids melting at –18.6 and –58.1°C, respectively. The electrical conductivities, viscosities, and densities of the pure molten compounds have been investigated over a range of temperatures. From these measurements the activation energies of ionic migration and viscous flow have been calculated, and degrees of ionic dissociation have been estimated. The compounds show well-defined decomposition potentials above which electrolysis liberates hydrogen at the cathode. Boron trifluoride–monomethanol is shown to be methoxytrifluoroboric acid, $H^+[BF_3{\cdot}OCH_3]^-$, and boron trifluoride–dimethanol proves to be methoxonium methoxytrifluoroborate, $[CH_3OH]^+[BF_3{\cdot}OCH_3]^-$. These results permit an interpretation of the catalytic activity of the boron trifluoride–methanol system. (auth)

1373

Atomic Energy Research Establishment, Harwell, Berks (England)

THE SOLUBILITY OF HELIUM IN CERTAIN TYPICAL LUBRICANTS AND MERCURY, by T. R. Moss. Sept. 1951. 16p. (AERE-E/R-754)

An apparatus for the determination of solubilities of helium in various liquids is described. The solubilities of helium in Shell rotary vacuum pump oil, castor oil, Esso synthetic oil, blown rapeseed oil, DC 200/200 silicone fluid, and mercury at high pressures and varying temperatures were measured to an estimated accuracy of 10%. The relationship between solubility and pressure is shown to be linear up to at least 25 atm. in the case of Shell rotary vacuum pump oil. The effect of temperature on solubility in the above fluids was studied over a temperature range 20 to 140°C at 25 atm. In general an increase in temperature increases the solubility. (auth)

1374

Brookhaven National Lab.

SALT AND ACID EFFECTS ON THE THALLOUS-THALLIC EXCHANGE REACTION, by Richard W. Dodson. [nd] 11p. (BNL-1307)

The thallous-thallic exchange reaction in perchloric acid-Na perchlorate mixtures has been studied at 50°C. Measurements were made at values of ionic strength and acid concentration ranging independently from 0.5 to 6.0 molar. The results are in good quantitative agreement with those of two earlier investigations, which could not be compared formerly because of the different ionic strengths employed. Reasons for doubting that unhydrolyzed thallic ion participates significantly in the reaction are given, but a firm proof of this point is not yet available. At high ionic strengths and constant acid concentration the rate decreases as the ionic strength is increased. This effect is consistent with the behavior of activity coefficients of electrolytes at high concentrations. (auth)

1375

Radiation Lab., Univ. of Calif., Berkeley

A POSSIBLE PRIMARY QUANTUM CONVERSION ACT OF PHOTOSYNTHESIS, by M. Calvin and J. A. Barltrop. Dec. 5, 1952. 7p. (UCRL-2024)

To account for the observation that illumination prevents the appearance of newly assimilated carbon in the compounds of the tricarboxylic acid cycle, it has been suggested that the light shifts the steady-state condition of the thioctic acid–containing coenzyme (protogen, lipoic acid, thioctic acid, P.O.F.) toward the reduced (dithiol) form. Some observations are reported leading to the further suggestion that this shift toward the dithiol form is the direct result

of the light action and that a biradical formed by dissociation of the disulfide bond in a strained five-membered disulfide-containing ring (as in 6,8-thioctic acid and trimethylenedisulfide) is the species in which the quantum absorbed by the plant pigments and stored as electronic excitation in chlorophyll appears first as chemical-bond potential energy. (G.Y.)

1376

ISOTOPE EFFECTS IN THE IONIZATION OF ALKYL CHLOROSULFITES. Edward S. Lewis and Charles E. Boozer. J. Am. Chem. Soc. 74, 6306-7(1952) Dec. 20.

In order to study the mechanism of the elimination reaction which accompanies the displacement of the chlorosulfite group by chloride in the decomposition of secondary alkyl chlorosulfites, the authors have studied the kinetics and products from the decomposition of an extensively deuterated 2-pentyl chlorosulfite in dioxane. The rate of chloride production is appreciably reduced by the D substitutions, although all bonds to hydrogen in the chlorosulfite are intact in the product. The source of this unusual isotope effect appears to be the weakening of the bonds to the hydrogen in the 1- and 3-positions in the carbonium ion and the transition state due to hyperconjugation structures with no bond to hydrogen. The failure to observe significant isotope fractionation in olefin formation can also be attributed to the great weakness of these bonds at the stage when the olefin is formed. The authors believe that this type of isotope effect can be used to detect hyperconjugation in the transition state and hence may be used as a measure of the extent of electron deficiency on carbon in the transition state of a displacement reaction. (G.Y.)

1377

CHICAGO RADIOCARBON DATES, III. W. F. Libby. Science 116, 673-81(1952) Dec. 19.

Numerous archeological specimens are described and dated. The age determinations were performed over the period Sept. 1, 1951 to Sept. 1, 1952. (G.Y.)

ANALYTICAL PROCEDURES

1378

Atomic Energy Research Establishment, Harwell, Berks (England)

THE SPECTROPHOTOMETRIC DETERMINATION OF SILICON IN BISMUTH OXIDE OR METAL, by M. Gibson. May 1950. 18p. (AERE-C/R-521)

A method for the spectrophotometric determination of silicon in bismuth oxide or metal and experimental work leading to the establishment of the method are described. The method is based on the formation of the molybdosilicic acid complex, its subsequent reduction to molybdenum blue by ascorbic acid, and the measuring of the optical density of the molybdenum blue, a function of the silicon present, using the Spekker photo-electric absorptiometer. Interfering elements, the use of ascorbic acid as a reducing agent, and a number of theoretical aspects in connection with molybdenum blue are discussed. The method, as written, is applicable to silicon contents of 5 to 35 ppm with an error not exceeding ±1.5 ppm. (auth)

1379

Atomic Energy Research Establishment, Harwell, Berks (England)

DETERMINATION OF THE ^{235}U CONTENT OF MIXTURES OF THE NATURALLY OCCURRING URANIUM ISOTOPES BY RADIOACTIVATION, by A. P. Seyfang and A. A. Smales. Oct. 3, 1952. 23p. (AERE-C/R-980)

A method previously used for determining U in minerals by neutron irradiation followed by separation and measurement of fission-product Ba has been extended to the determination of U^{235} in admixture with U^{234} and U^{238}. With microgram quantities of U^{235} very short irradiations in the Harwell pile give ample sensitivity, and a precision and accuracy of better than ±2% have been achieved over a range of U^{235} contents covering a factor of $>10^5$. (auth)

1380

Los Alamos Scientific Lab.

SOLUBILITY OF CARBON DIOXIDE IN DRY TOLUENE AND SCINTILLATION COUNTING OF C^{14} CARBON DIOXIDE, by D. L. Williams. Oct. 1952. 14p. (LA-1484)

The solubility of CO_2 in toluene as a function of temperature was studied to determine the feasibility of counting $C^{14}O_2$ in a toluene liquid scintillation counting system. The counting of C^{14} as CO_2 in a liquid scintillation system of toluene and 2,5-diphenyloxazole was shown to be possible. The method does not, however, appear feasible for the routine assay of large numbers of biological samples of low specific activity. The time and labor involved in preparing samples of CO_2 dissolved in the scintillator medium appear to be prohibitive. The method calls for rigid control of conditions of temperature and pressure. At −80° and 1 atm. of CO_2 pressure, 40 g of toluene would dissolve about 0.039 mole of CO_2 which is equivalent to only 0.47 g of carbon. (auth)

1381

North American Aviation, Inc.

A STUDY OF THE COLORIMETRIC DETERMINATION OF MICRO AMOUNTS OF BORON BY THE CURCUMIN-ACETONE SOLUTION METHOD, by L. Silverman and K. Trego. Issued Jan. 12, 1953. 19p. (NAA-SR-203)

A detailed study has been made of the effects of variations of the amounts of reagents used in the boron-curcumin reaction, as applied to the colorimetric determination of boric acid or borate in solutions of low solids content. The procedure is effective in ordinary or in heavy-water solutions, for analysis down to detectable 0.02 gamma of boron (contained in a 10-ml standard volume of solution plus reagents). Precautions are described which must be observed with reagents and apparatus in order to avoid contamination at low boron contents (0.1 gamma or less). (auth)

1382

ANALYTICAL CHEMISTRY OF ASTATINE. A. H. W. Aten, Jr., T. Doorgeest, U. Hollstein, and H. P. Moeken. Analyst 77, 774-7(1952) Nov.

The preparation of astatine by bombardment of Bi oxide by He ions in the Amsterdam cyclotron is described, and methods for carrying, separating, and counting the At^{211} are discussed. (auth)

1383

POTENTIOMETRIC TITRATIONS INVOLVING SOLUTIONS OF METALS IN LIQUID AMMONIA. George W. Watt and John B. Otto, Jr. J. Electrochem. Soc. 98, No. 1, 1-8(1951) Jan.

A relatively simple apparatus for use in potentiometric titrations in which the titrating reagents consist of solutions of alkali metals (or alkaline earth metals) in liquid ammonia at −38°C is described, together with complete procedural and operational details. The utility of these methods has been demonstrated in the study of the formation of polyanionic salts by reactions between polysulfides of sodium, potassium, rubidium, and cesium in liquid ammonia and liquid ammonia solutions of the corresponding metals. (auth)

1384

COLORIMETRIC AND VOLUMETRIC ESTIMATION OF ZIRCONIUM. S. K. Dhar and A. K. Das Gupta. J. Sci. Ind. Research (India) B11, 500-1(1952) Nov.

Oxalohydroxamic acid, which forms appreciable precipitates from ammoniacal tartrate solutions containing minute

amounts of Zr, is a suitable reagent for indirect colorimetric estimation of Zr. The Zr oxalohydroxamate is readily soluble in dilute acetic acid in which the oxalohydroxamic acid is stable and can be estimated as its characteristic purple ferric complex. Since the reagent corresponding to 1 μg of Zr gives with ferric ion an easily measurable intensity of color, the limit of Zr determination lies in the smallest amount of precipitate that can be collected and filtered. For quantities greater than 10 mg of Zr a volumetric procedure involving solution of the precipitate in dilute HCl, hydrolysis of the resulting acid to oxalic acid and hydroxylamine, addition of excess titanous chloride, and titration with standard ferric solution is recommended. (G.Y.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1385

SOME INTERMETALLIC COMPOUNDS OF URANIUM WITH ELEMENTS OF GROUPS III AND IV. Aldo Iandelli and Riccardo Ferro. Ann. chim. (Rome) 42, 598-606(1952) Oct. (In Italian)

Alloys of U with high percentages of Ga, In, Tl, Si, Ge, and Pb were studied by x-ray diffraction. Data from powder diffraction diagrams are tabulated, and the following cell constants (a_0) are calculated: UGa_3, 4.249; UIn_3, 4.588; UTl_3, 4.675; USi_3, 4.034; UGe_3, 4.193; and UPb_3, 4.737 A. U and Mg were found to be immiscible. (G.Y.)

FLUORINE AND FLUORINE COMPOUNDS

1386

FLUORIDE MODEL SYSTEMS. II. THE BINARY SYSTEMS CaF_2-BeF_2, MgF_2-BeF_2, and $LiF-MgF_2$. W. E. Counts, Rustum Roy, and E. F. Osborn. J. Am. Ceram. Soc. 36, 12-17(1953) Jan.

Data obtained by quenching, thermal, and high-temperature x-ray techniques are presented for the three binary systems CaF_2-BeF_2, MgF_2-BeF_2, and $LiF-MgF_2$. The systems CaF_2-BeF_2 and MgF_2-BeF_2 are presented as weakened models of the systems ZrO_2-SiO_2 and TiO_2-SiO_2, respectively. The compound $CaBeF_4$ is a model of $ZrSiO_4$ (zircon). New data obtained for the system $LiF-MgF_2$ explain many discrepancies among the results of previous authors. Solid solution is almost complete between LiF and MgF_2 at elevated temperatures, but a small gap occurs at the eutectic (735°C) with extensive exsolution at lower temperatures. (auth)

GRAPHITE

1387

CARBON AND GRAPHITE. J. P. Oliver. Chem. Eng. 59, 276-84(1952) Sept.

Data are presented on the physical properties, forms available, applications, fabrication, and general chemical resistance of C and graphite. Particular emphasis is given the corrosion resistance of impervious graphite to about 80 different chemicals. (L.M.T.)

LABORATORIES AND EQUIPMENT

1388

Knolls Atomic Power Lab.

AN APPARATUS FOR RESEARCH IN VACUUM-FUSION ANALYSIS, by William S. Horton. [nd] 19p. (AECU-2342)

This report describes the apparatus designed and constructed for research in vacuum-fusion analysis. Diagrams show the arrangement and some of the individual components. The apparatus appears to be unique in the use of glass-mercury solenoid valves instead of stopcocks or U-type mercury cut-offs. The blank rate is as satisfactory as those of other laboratories. The results for National Bureau of Standards samples of "Cooperative Steels" compare favorably with those reported by the cooperators. It was found that 10-min measurements gave the same blank rate as 20-min measurements. The presence of stopcock grease gave a measurably higher blank rate than when the grease was absent. The increase was small, however, and should only interfere with obtaining extremely low blanks. There is reason to believe that the grease would have a greater effect on the blank rate of the low-pressure method for determining carbon in steels. (auth)

1389

Brookhaven National Lab.

PIPET FILLER, by H. L. Finston and Gerald Strickland. Nov. 18, 1952. 3p. (BNL-1313)

A pipet filler consisting of a Teflon tapered bushing fitted into a rubber bulb which overcomes difficulties such as inaccuracy and awkwardness usually encountered in the use of rubber bulbs and rubber bushings is described. The pipet is held tightly in the tapered bushing with the right hand until filled above the calibration mark, the bushing is removed, and the index finger of the right hand is placed over the end of the pipet. The meniscus can then be brought to the calibration mark with an accuracy considerably greater than 0.1 ml. Pipets ranging in volume from 1 to 50 ml can be filled in one operation. (L.T.W.)

1390

North American Aviation, Inc.

SIMPLE EQUIPMENT AND TECHNIQUES FOR A SMALL CRYOGENICS LABORATORY, by N. S. Rasor. Issued Jan. 8, 1953. 29p. (NAA-SR-201)

Simple techniques and easily constructed equipment are described for a small cryogenics laboratory utilizing a commercial helium liquefier. Emphasis is placed on simplicity and availability rather than on high accuracy and efficiency in low-temperature work. Accessories for a Collins liquefier and a commercial liquid-helium storage container are described. Techniques used for reaching and measuring intermediate temperatures are outlined, along with a description of two portable cryostats. A small mica and pyrex platinum resistance thermometer has been developed, and its relatively simple fabrication is described. (auth)

MOLECULAR STRUCTURE

1391

RELATION BETWEEN VIBRATION FREQUENCIES OF ISOTOPIC MOLECULES (SUMS OF PRODUCTS RULES). L. M. Sverdlov. Doklady Akad. Nauk S.S.S.R. 36, 513-16 (1952) Sept. 21. (In Russian)

RADIATION CHEMISTRY

1392

Syracuse Univ.

PHOTOCHEMICAL REACTIONS OF COMPLEX MOLECULES IN CONDENSED PHASE, by Henry Linschitz. Dec. 15, 1951. 30p. (NYO-655)

Studies on reversible photochemical energy-storing reactions in rigid solvents reveal that in a given solvent photochemical electron transfers may occur either to or from the light-absorbing molecule. The same semiquinone is formed by illumination of diphenyl-p-phenylenediimine and the corresponding phenylenedianine. This imine semiquinone is also formed in solutions containing the imine and a sensitizing dye under irradiation absorbed only by the dye. Synthetic Zn tetraphenylchlorin and chlorophyll react similarly with quinone, indicating that chlorophyll is oxidized in the dihydroporphyrin ring. The chlorophyll absorption spectrum in rigid solutions indicates the reversible forma-

tion of the semiquinone by reaction with the solvent. New absorption bands due to trapped electrons and to radicals formed from the luminescent molecules by electron photoejection were observed in amine-containing glasses. Hindrance by aromatic molecules of hydrocarbon radiodecomposition due to stable triplet states formed by recombination of electrons and aromatic radicals is proposed. In deoxygenated p-xylene, at 122°C, the decomposition of tetralinhydroperoxide is initially first order, but autocatalytic effects later appear. Complex formation between metal porphyrins and basic solvents was demonstrated. In acetate-buffered ethanol, chlorophyll has a single polarograph reduction wave at –1.1 v. On standing, new waves appear at –0.73 and –1.3 v. Results on characteristic waves in chlorophyll homologs are given. Synthetic and purification procedures were developed for preparing metal porphins and chlorins. Three papers are also included which have been submitted for publication in journals. (see NYO-654 for 1950). (L.T.W.)

1393

RADIATION CHEMISTRY. A. O. Allen. Ann. Rev. Phys. Chem. 3, 57-76(1952).

This literature review for the calendar year 1951 covers the radiation chemistry of gases, aromatic compounds, other organic materials, ionic solids, and chemical dosimetry. 118 references (L.M.T.)

RADIATION EFFECTS

1394

Atomic Energy Research Establishment, Harwell, Berks (England)

THE DECOMPOSITION OF POLYTETRAFLUORETHYLENE BY PILE RADIATION, by A. Charlesby. July 10, 1952. 10p. (AERE-M/R-978)

To determine whether the presence of hydrogen atoms is necessary to permit crosslinking of polymers under irradiation, the behavior of PTFE was compared with that of polythene. Under irradiation PTFE is found to break up, but there is no evidence of crosslinking. This effect which is mainly due to γ radiation is ascribed to the preferential fracture of C-C bonds in the main chain. No definite evidence is available that fluorine itself is liberated. The change in weight ΔM with radiation dose R depends only on the surface area A, and not on the mass irradiated: $\Delta M = -\beta_2 AR^2$; $\beta_2 = 0.0125$ mg/cm^2. This equation is very similar to one of the mass-loss terms found in polythene, where it is ascribed to the fracture of C-C bonds within the molecule, with subsequent evolution of hydrocarbons (such as CH_4, C_2H_6) only if they are liberated near the surface. In the case of PTFE the evolution of the analogous fluorocarbon CF_4 has been observed. In polythene the weight loss term is ascribed to the liberation of hydrogen. In PTFE, no such term is observed, nor has the analogous fluorine gas been detected among the gaseous products. (auth)

395

RADIATION EFFECTS AS A FUNCTION OF DOSE RATE. Arno Brasch, Wolfgang Huber, and Adnan Waly. Arch. Biochem. and Biophys. 39, 245-7(1952).

Dose-rate effects were determined with high-intensity electron bursts within a dose-rate range as small as 9:1. A plot shows the ionic yield for 0.001 to 0.1% solutions of tartrazine (mol. wt. 468) in oxygen-saturated H_2O (pH 6.8) at room temperature for a dose of 8×10^6 ergs/g with the dose rate as a parameter. The over-all yield was calculated as the ratio of the number of dye molecules destroyed to the number of ions formed for the given dose, taking 32.5 ev as necessary to produce one ion pair. The yield for the 0.001% dye concentration was found to vary approximately with the cube root of the dose rate. The ratio of yields for a dose-rate ratio of 1:9 is greater the higher the concentration of the dye. (L.M.T.)

1396

EFFECT OF HIGH-ENERGY CATHODE RAYS ON CELLULOSE. Jerome F. Saeman, Merrill A. Millett, and Elliott J. Lawton. Ind. Eng. Chem. 44, 2848-52(1952) Dec.

Irradiation of cellulose with high-voltage cathode rays causes depolymerization, reduction in crystallinity, and extensive decomposition at high dose levels. Cotton linters and a purified wood pulp were depolymerized at nearly the same average chain length. At a dose of 5×10^8 rep, the cotton linters were converted to water-soluble materials. Conversion of glucose anhydride units to noncarbohydrate material occurs simultaneously with the depolymerization of cellulose. The decomposition of glucose, wood pulp, and cotton linters occurs at similar rates, amounting to a fraction of a per cent at 10^6 rep and, in the case of the cotton linters, to 44% at 5×10^8 rep. The maximum over-all yield of sugar obtainable by the batch-wise dilute acid hydrolysis of irradiated cotton linters is about 65% and the corresponding yield from purified wood pulp is over 70%. (auth)

SEPARATION PROCEDURES

1397

Knolls Atomic Power Lab.

NOTE ON BOMB REDUCTION OF CHROMIUM TRIFLUORIDE WITH CALCIUM, by A. P. Beard. [nd] 4p. (AECU-2344)

Attempts to prepare pure Cr by the bomb reduction of CrF_3 with 50%-excess high-purity Ca are reported. Two lots of commercial grade CrF_3 were used, one being purified to drive out the 0.8 to 0.9% H it contained. A typical charge for the closed, Mg-O lined, steel container was CrF_3 = 300 g, Ca = 275 g, and I_2 (booster) = 140 g. Several reductions proceeded with explosive violence and yields varied from 75 to 90% of theoretical predictions. The Cr buttons obtained were brittle, contained slag-reaction products, and the second phase at the grain boundaries was believed to be a Cr oxide. (L.M.T.)

1398

Atomic Energy Research Establishment, Harwell, Berks (England)

LIQUID-LIQUID EXTRACTION: A CRITICAL SURVEY OF THE LITERATURE DEALING WITH THE MECHANISM OF TRANSFER OF SOLUTES ACROSS PHASE BOUNDARIES WITH SPECIAL REFERENCE TO LIQUID-LIQUID INTERFACES, by J. B. Lewis. Nov. 1950. 21p. (AERE-CE/R-910)

The literature dealing with the theory of mass transfer between two liquid phases is critically examined. The analogous cases of mass transfer in solid-liquid and in gas-liquid systems, and of heat transfer, are also considered. It is shown that the Whitman two-film concept, which is frequently used as the basis of approximate correlations of experimental data, is only applicable when the chemical reaction rate is known to be considerably faster than the diffusion rate. In a large number of cases where chemical reaction occurs diffusion is not the controlling factor and care must therefore be taken that the Whitman concept is not employed indiscriminately. The effect of stirring on reaction rate is shown to be an excellent criterion of the extent to which diffusion is the controlling factor. Similarly, the temperature coefficient is a useful guide to the extent to which chemical reaction predominates, since the temperature coefficient of chemical reactions is much greater than that of diffusion. The properties of ions at the interface are reviewed, and it is shown that the bulk partition

coefficient is not necessarily the same as that at the interface. (auth)

1399

Radiation Lab., Univ. of Calif., Berkeley

SEPARATION OF TANTALUM AND NIOBIUM BY SOLVENT EXTRACTION, by Peter C. Stevenson and Harry G. Hicks. Nov. 12, 1952. 13p. (UCRL-2009)

Ta and Nb are separated by extraction into diisopropyl ketone from mineral acid-hydrofluoric acid aqueous phases. Behavior of Ta is presented in detail, although no conclusions as to species present are reached. Radiochemical separation procedures for Ta and Nb are given. (auth)

1400

EXTRACTION OF ZIRCONIA FROM ZIRCON. S. R. Patel. J. Sci. Ind. Research (India) B11, 502-3(1952) Nov.

Recovery of ZrO_2 from H_2SO_4 solutions in the form of $MgSO_4.Zr(SO_4)_2$, which is completely hydrolyzed on boiling with H_2O, was investigated. Optimum Mg and H_2SO_4 concentrations are discussed. A ZrO_2 yield of 92% of theory was obtained from a sample of zircon by this method. (G.Y.)

SPECTROSCOPY

1401

Atomic Energy Research Establishment, Harwell, Berks (England)

THE INFRA-RED SPECTRA AND MOLECULAR STRUCTURE OF SOME INORGANIC HEXAFLUORIDES: PART 2. WF_6 AND MoF_6, by J. Gaunt. Oct. 22, 1952. 8p. (AERE-C/R-1023)

The infrared spectra of WF_6 and MoF_6 have been observed in the region 2 to 25 μ. The great similarity between the spectra of these molecules and those reported in Part 1 of this series for SF_6 and UF_6 suggests that these molecules also belong to the point group O_h and have totally symmetric octahedral structures. An interpretation of the observed bands has been made along these lines with considerable success. The thermodynamic properties have been calculated. (auth)

1402

Radiation Lab., Univ. of Calif., Berkeley

ABSORPTION SPECTROSCOPY IN LIQUID AMMONIA, by William L. Jolly. Oct. 1952. 22p. (UCRL-2008)

Following a brief review of the literature on absorption spectroscopy of liquid NH_3 and substances dissolved therein, experimentally determined absorption spectra are presented for H_2O, NH_3, and the following substances in liquid NH_3: iodide ion in the ultraviolet, and H_2O, cupric ion, permanganate, polysulfide, and Na in the visible and infrared. The adsorption spectrum of Na in liquid NH_3 was measured from 3500 to 25,000 A; the maximum was found at 1.50 ± 0.15 μ. The theory of metal solutions in NH_3 is discussed briefly. 32 references. (G.Y.)

URANIUM AND URANIUM COMPOUNDS

1403

National Bureau of Standards

AN ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES ON THE SOLID-STATE REACTIONS OF THE URANIUM OXIDES, by S. M. Lang. Issued Jan. 9, 1953. 95p. (NBS-CIR-535)

This report consists of an annotated bibliography of 257 references, and about 60 not abstracted, on the solid-state reactions of the uranium oxides with 36 other oxides and on the properties, crystal structure, and solid-state reactions (including oxidation and reduction) of UO_2, U_2O_5, U_3O_8, and UO_3 as reported in the literature. Subject and author indexes are included. (auth)

1404

THE COMPLEXES FORMED BY THORIUM AND URANYL IONS WITH COMPLEXONES. M. J. Cabell. Analyst 77, 859-66(1952) Dec.

The Calvin-Bjerrum method has been used to study the formation of complexes of Th and uranyl ions with nitrilotriacetic acid ("trilo") and ethylenediaminetetra-acetic acid ("enta"). With Th the formation of definite stable ionic species is indicated. The uranyl complexes are much less stable, hydrolyse more readily and the U is readily precipitated. The results are discussed in relation to the stability of the complexonates of uni-, bi-, and ter-valent cations. (auth)

1405

METALLIC COMPLEXES OF SALICYLALDEHYDE, THEIR COMPOSITIONS AND STRUCTURE, BEHAVIOR AND STABILITY. II. SPECTROPHOTOMETRY OF SALICYLALDEHYDE AND ITS COMPLEXES WITH COLORLESS CATIONS IN SOLUTION. M. Bobtelsky and C. Heitner. Bull. soc. chim. France, 938-42(1952) Nov.-Dec. (In French)

Absorption spectra and properties of complexes of Al, Th, La, Ce, Zr, Ba, Mg, Mn, Zn, and Cd with salicylaldehyde have been determined. 11 figures. (G.Y.)

1406

METALLIC COMPLEXES OF SALICYLALDEHYDE, THEIR COMPOSITIONS AND STRUCTURE, BEHAVIOR AND STABILITY. III. INVESTIGATION OF COMPLEXES OF SALICYLALDEHYDE WITH COLORED CATIONS. M. Bobtelsky, C. Heitner, and K. R. S. Ascher. Bull. soc. chim. France, 943-9(1952) Nov.-Dec. (In French)

Absorption spectra and properties of complexes of Ni, Co, Cu, V, UO_2^{++}, Fe, and Cr have been determined. 17 figures. (G.Y.)

ENGINEERING

1407

Atomic Energy Research Establishment, Harwell, Berks (England)

A SIMPLE R. F. HEAT SEALING DEVICE FOR THIN PLASTIC CONTAINERS, by W. R. E. Maton. Aug. 16, 1952. 15p. (AERE-C/R-1004; HD-744)

A small r-f oscillator with a low power (~60 w) output is described together with roller type electrodes, for seam welding. Use of the equipment for sealing plastic bags containing α-active material is described. The oscillator may also be used for low-power induction heating requirements. It is constructed from standard components and is portable. (auth)

1408

Knolls Atomic Power Lab.

STRESSES AND DEFLECTIONS OF FRAMEWORK UNDER ACTION OF FORCES AND MOMENTS, by G. Horvay and R. T. Gray. Oct. 31, 1952. 39p. (KAPL-661)

An exact solution and a conventional (approximate) method of solution is presented for a certain symmetrical three-member elastic framework under the action of a vertical load, a horizontal load, and a moment. It is shown that the conventional method is applicable for most of these frameworks encountered. Formulas are developed using the conventional method for a more generalized framework which includes the above-mentioned framework as a special case. The analysis is useful for estimating the stresses in plates with large cutouts having the configurations considered. (auth)

1409
BARYTA AS A SUBSTITUTE FOR LEAD TO PROTECT AGAINST RADIATION. Morris Fishbein. Postgrad. Med. 12, 492(1952) Nov.

The use in Portugal of a Ba monoxide ore between cork plates as a substitute for Pb for protection against radiation is described. It is pointed out that marble and Virginia soapstone, both readily available in this country, have better radiation protection characteristics than does any of Ba monoxide ores or the high-density concretes. (C.R.)

HEAT TRANSFER AND FLUID FLOW

1410
Argonne National Lab.
PRESSURE DROP IN TWO-PHASE FLOW, by D. H. Weiss. Oct. 20, 1952. 48p. (ANL-4916)

This report was issued as AECU-2180 and abstracted in Nuclear Science Abstracts as NSA 6-5590.

1411
Georgia Inst. of Tech.
THE TRANSFERENCE OF HEAT BETWEEN A PIPE WALL AND A LIQUID-SOLID SUSPENSION FLOWING TURBULENTLY INSIDE THE PIPE. THE THERMAL CONDUCTIVITY AND VISCOSITY OF A LIQUID-SOLID SUSPENSION (thesis), by Clyde Orr, Jr. Dec. 1952. 160p. (NP-4310)

Heat transfer to suspensions of attapulgus clay, powdered Cu, glass beads, powdered graphite, or powdered Al in H_2O or powdered graphite or Al in ethylene glycol flowing in a $\frac{3}{8}$-in. Cu pipe and viscosities and thermal conductivities of these suspensions were determined experimentally. The following conclusions are drawn. The average individual coefficient of heat transfer between a pipe wall and a liquid-solid suspension flowing turbulently inside the pipe is given by the well-known Dittus-Boelter equation for dilute suspensions and by Sieder and Tate's relation

$$\frac{hD}{k_s} = 0.027\left(\frac{Dv\rho_s}{\mu_s}\right)^{0.8}\left(\frac{C_{ps}\mu_s}{k_s}\right)^{1/3}\left(\frac{\mu}{\mu_w}\right)^{0.14}$$

for all concentrations studied if thermal conductivity and viscosity are evaluated by the following equations, if density and heat capacity are calculated as the weighted average of the values for the individual components, and if other terms are evaluated in the usual fashion. The thermal conductivity of a liquid-solid suspension is given by Tareef's relation

$$k_s = k_L\,\frac{2k_L + k_p - 2F(k_L - k_p)}{2k_L + k_p + F(k_L - k_p)},$$

where F is the fraction of solid material by volume. The viscosity of a liquid-solid suspension is described adequately for heat-transfer purposes by the relation

$$\mu_s = \frac{\mu_L}{\left(1 - \frac{F}{F_b}\right)^{1.8}}.$$

Resistance to the turbulent flow of a suspension in a pipe may be predicted from a Fanning-friction-factor vs. Reynolds-number plot, provided that the viscosity of the pure liquid and the density of the suspension are used in evaluating the Reynolds number. (G.Y.)

1412
HEAT TRANSFER IN CONDENSATION. EFFECT OF TEMPERATURE VARIATION AROUND A HORIZONTAL CONDENSER TUBE. LeRoy A. Bromley, Robert S. Brodkey, and Norman Fishman. Ind. Eng. Chem. 44, 2962-9(1952) Dec.

The Nusselt equation (Z. Ver. deut. Ing. 60, 541-6, 569-75 (1916)) for the heat transfer coefficient in horizontal condenser tubes was derived assuming constant temperature of the tube, but this is thought not to be valid in the case of large-diameter, thin, stainless steel or monel tubes. The error from this assumption is examined both theoretically and experimentally. The Nusselt equation also predicts that the effects of a heat capacity of the condensate film is to decrease the heat transfer coefficient. This prediction is also shown to be in error. An expression is developed for calculating this effect. (L M.T.)

1413
ON HEAT TRANSFER FROM HIGH-PRESSURE SUPERHEATED STEAM INSIDE INTERTUBULAR SPACE. V. L. Lel'chuk. Izvest. Vsesoyuz. Teplotekh. Inst. im. Feliksa Dzerzhinskogo, No. 4, 18-21(1952) Apr. (In Russian)

It is experimentally established that the heat-transfer process in the case of superheated steam flowing inside an annular gap between two pipes is in good agreement with law established for steam flow in pipe up to very high values of Re (1,750,000 for pipes and 1,000,000 for gap). The results obtained by McAdams et al. (Trans. Am. Soc. Mech. Engrs. 72, No. 4(1950)) are discussed.

1414
HEAT TRANSFER TO A BOILING LIQUID. J. Elmer Rhodes, Jr. Am. J. Phys. 21, 67-8(1953) Jan.

Suitable apparatus was devised for heating a Cu surface immersed in liquid N_2 and also for measuring the temp. difference between the Cu and the liquid N_2. A plot compares heat transfer from the Cu surface, from a Cu surface sheathed in ice, and through a thick film of gas. Stable temp.-power conditions were obtained for the Cu surface up to 72 watts/cm^2 (70 watts/cm^2 for the ice-sheathed Cu), where "contact" type of transfer ceased and the temp. of the surface rose several hundred degrees. It is proposed that "contact" transfer is really transfer through a film of gas whose thickness is less than the mean free path of molecules in the gas. Molecules evaporate from the liquid through this gas layer and strike the hot solid surface where they pick up energy and return to the liquid. "Non-contact" heat transfer is effected through a film of gas much thicker than the mean free path. (L.M.T.)

MATERIALS TESTING

1415
Knolls Atomic Power Lab.
ULTRASONIC TESTING OF SMALL-DIAMETER TUBING, by A. J. Pardus. Feb. 1, 1952. Decl. Dec. 16, 1952. 30p. (AECD-3485; KAPL-808)

With the development of the procedure and equipment outlined in this report, ultrasonics can be applied successfully to locate flaws in 0.060 in. ID × 0.080 in. OD tubing. By means of high-frequency pulsating sound waves sent into the tubing to be tested, flaws are located by reflection of the sound waves from the defect. Any discontinuity, as well as the opposite end of the tubing, will reflect the wave back to the searching unit which presents it on the reflectoscope. In the testing of thin-walled tubing, a shear wave is generated by an angle quartz crystal, and is sent angularly into the tubing being tested. Best results were obtained with a 1-Mc, 1-in. quartz-crystal, angle-searching unit. Higher-frequency crystals, 2¼ and 5 Mc, were also tried but were unsuccessful due to high attenuation of the sonic energy. Prior to the development of this procedure, no satisfactory means of detecting and measuring defects in small-diameter, thin-walled tubing had been available. (auth)

1416
Atomic Energy Research Establishment, Harwell, Berks (England)
MICROHARDNESS TESTING OF METALS: PART I. EXPERIMENTS ON TWO TYPES OF TESTER, by B. W. Mott

and S. D. Ford and PART II. AN ANALYSIS OF THE VARIATION OF MICROHARDNESS WITH LOAD, by E. R. W. Jones. Sept. 23, 1952. 40p. (AERE-M/R-1017)

The results of microhardness tests on a variety of metals on a Tukon machine are given and compared with those obtained on the same specimens with a Cooke, Troughton, and Simms tester. Scatter tests were carried out at three different loads, and attempts were made to modify the Tukon tester for operation at loads of less than 25 g. The main conclusion is that although comparison tests can be made on two specimens at low loads, the hardness numbers obtained are not representative of the true hardness of the material at loads of less than about 100 g on the Tukon machine and about 15 g on the C.T.S. tester. The results of some previous workers have been analyzed, and it is shown that the variation of hardness with load is more a characteristic of the machine used than of the material tested. Various possible causes of this "machine effect" have been examined and their results described. (auth)

1417

Illinois Univ.

AN APPRAISAL OF THE PROT METHOD OF FATIGUE TESTING (PART I), by A. P. Boresi and T. J. Dolan. Jan. 1953. 33p. (NP-4311; Technical Report No. 34)

The validity of the Prot formula (Revue de Métallurgie 45, 481(1948)), $S_R = E + K\alpha^{0.50}$, where S_R is the stress at failure, E is the endurance limit, K is a constant for a particular material, α is the loading rate, and of a closely related formula, $S_R = E + K\alpha^{1/m+1}$, where m is a constant dependent on the material, was investigated for ingot Fe and 75S-T Al alloy. The values for the exponent of α for a linear relationship when plotted against E_R were found to be 0.371 and 0.1786 rather than 0.50, for ingot Fe and 75S-T Al alloy, respectively. The endurance-limit values of the two materials were found to be affected by completely reversed stresses whose amplitudes were smaller than the endurance limit. (L.M.T.)

PUMPS

1418

Oak Ridge National Lab., Y-12 Area

PERFORMANCE CHARACTERISTICS FOR A GENERAL ELECTRIC G-3 ELECTROMAGNETIC PUMP, by A. G. Grindell. Oct. 24, 1951. 14p. (Y-F17-9)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

1419

Massachusetts Inst. of Tech.

PROGRESS REPORT [ON] STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES, by F. H. Norton, W. D. Kingery, et al. Jan. 1, 1953. 4p. (NYO-3142)

Status of the work on surface tension and on the construction of an apparatus for the measurement of the effects of various impurities is reported. The surface tension of molten Al_2O_3 was measured (700 dyne/cm). Experimental study of the sintering mechanism of pure oxides is presented. (See NYO-3141) (J.E.D.)

1420

Massachusetts Inst. of Tech.

PROGRESS REPORT [ON] THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS, by F. H. Norton, W. D. Kingery, et al. Jan. 1, 1953. 12p. (NYO-3642)

Values of thermal conductivity have been obtained for samples with controlled cylindrical pores having porosity varying from 7 to 22%. These values for pores parallel to heat flow indicate a close agreement with calculations and an almost linear decrease of conductivity with porosity. Thermal conductivity measurements of Al_2O_3 by a cylindrical test method and a spherical test method are in close agreement with previously reported values. Data are reported for forsterite. Additional study of TiC is in progress. (See NYO-3641) (auth)

1421

Sintercast Corp. of America

INVESTIGATION OF INFILTRATED AND SINTERED TITANIUM CARBIDE, by C. G. Goetzel, J. B. Adamec, J. L. Ellis, and D. Trauberman. Apr. 1952. 52p. (WADC-TR-52-92)

An investigation was carried out for the purpose of evaluating composite bodies consisting of Ti carbide and Ni-base alloys and intermetallic compounds, produced by the infiltration and conventional powder metallurgical processes for use as structural materials in high-temperature components of aircraft engines. The Ni alloys and the one compound tested were Nichrome V, Hastelloy "C", Inconel, and NiAl, respectively. Production techniques were developed for 9-in.-long stress-rupture test bars, containing Inconel as infiltrant. Tests carried out on the material were: oxidation testing in air at 1600, 1800, and 2000°F; x-ray-diffraction analysis of the oxide products; thermal-shock testing at 2500 and 2300°F; modulus of transverse rupture at room temperature; modulus of transverse rupture at 1800°F; and ductility at 1800°F. It was found that, among the materials tested, Ti carbide-Inconel, infiltrated by the capillary infiltration method, had the most favorable combination of high-temperature strength, ductility, and oxidation resistance at elevated temperatures. Its facility of production, however, was inferior to that of Ti carbide infiltrated with other Ni alloys. While it was possible to produce from Inconel-infiltrated Ti carbide $3 \times \frac{1}{2} \times \frac{1}{2}$-in. specimens of great physical and structural uniformity, 9-in.-long bars required for stress rupture specimens still possessed some regions of less homogeneity as evidenced by microporosity. In the modulus of transverse rupture tests, the Inconel-infiltrated type of material proved to be far superior in strength at room temperature, strength at 1800°F, and bending capacity at 1800°F, over a cemented Ti carbide of similar composition made by cold-pressing and sintering. (auth)

1422

OXIDES OF TITANIUM IN THE RANGE $TiO_2 - Ti_2O_3$. N. E. Filonenko, V. I. Kudryavtsev, and I. V. Lavrov. Doklady Akad. Nauk S.S.S.R. 86, 561-4(1952) Sept. 21. (In Russian)

Phase studies of the $TiO_2 - Ti_2O_3$ system showed the existence of two crystalline phases of composition $Ti_2O_3 \cdot TiO_2$ (Ti_3O_5) and $Ti_2O_3 \cdot 3\text{-}4TiO_2$ and a new modification of TiO_2, distinguished by its optical properties. (G.Y.)

GEOLOGY AND MINERALOGY

1423

The Lovelace Foundation for Medical Education and Research, Albuquerque

FINAL REPORT [ON] PETROGRAPHIC AND MINERALOGICAL STUDIES OF LOS ALAMOS, NEW MEXICO ROCK SAMPLES RELATED TO WASTE DISPOSAL, by Carl W. Beck. Sept. 5, 1952. 34p. (AECU-2325)

Petrographic studies of the solid rock materials at Los Alamos, New Mexico, in the area of discharge of radioactive wastes reveal that the rock is, except for local slight differences, a welded tuff laid down as heavy, rolling,

gaseous, pyroclastic masses from the nearby volcano. The excess heat and gaseous nature of the pyroclastic material is attested to by the facts that the rocks contain many gas bubbles, microlites of sanidine grow into the bubbles, glass has eaten into some of the sanidine phenocrysts, and microlites of sanidine crystallize within some of the glass shards. The rocks are remarkably fresh with only small amounts of clay minerals present in the solid rock. Considering the appreciable amount of magnetite present, it is most plausible to ascribe the formation of the clay minerals, as well as the magnetite, to hydrothermal alteration. In unconsolidated core material, the percentage of clay minerals ranges from 3 to 10%. X-ray and differential thermal analysis studies of weathered materials in the area of discharge of radioactive wastes reveal that the clay minerals are of the three-layer lattice type, predominantly montmorillonite, subordinately illite. (auth)

1424

Bureau of Reclamation, Dept. of the Interior

FIELD TESTS FOR THE UNITED STATES ATOMIC ENERGY COMMISSION ON THE USE OF THE SEISMIC GEOPHYSICAL METHOD FOR TRACING "BURIED CHANNELS" IN THE MONUMENT VALLEY AREA, ARIZONA, by Dart Wantland and Robert D. Casey. Nov. 15, 1952. 51p. (G-123)

An investigation was made to test the seismic method of geophysical prospecting as applied to the mapping of buried channels in which U ore might be deposited. Results indicate that the seismic geophysical field tests were successful in accomplishing the objective for which they were undertaken. The objective was to test the usefulness of both refraction and reflection techniques of seismic prospecting. As a result of the investigations it was concluded that the seismic refraction method could be usefully applied in connection with and in advance of drilling to outline the course and configuration of buried channels. The seismic reflection method proved unsuitable for this purpose. That the above conclusions were valid was substantiated by core-drill results secured in exploration of a channel which was carried on with the seismic tests and continuing for some weeks following the completion of the geophysical work. (J.E.D.)

1425

Geological Survey

RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN THE SOUTHERN COOK INLET REGION, ALASKA, 1949, by Robert M. Moxham and Arthur E. Nelson. 1952. 8p. (GS-C-207)

Reconnaissance for radioactive deposits in the Iliamna Lake-Lake Clark region included the examination of two silver-lead occurrences and five copper deposits, one of which had been reported earlier to contain uranium; the radiometric testing of numerous concentrates from gravels of streams draining the more inaccessible areas; and about 310 miles of radiometric traversing with portable survey meters. The maximum equivalent uranium content of any material tested did not exceed 0.009%. No radioactive materials of any consequence occur in the immediate vicinity of Jakolof Bay. (auth)

1426

Minnesota Univ.

MINERAL ASSOCIATIONS IN THE URANIUM DEPOSITS OF THE COLORADO PLATEAU AND ADJACENT REGIONS WITH SPECIAL EMPHASIS ON THOSE IN THE SHINARUMP FORMATION; PART III. ANNUAL REPORT [FOR] JULY 1, 1951 TO JUNE 30, 1952, by John W. Gruner and Lynn Gardiner. Nov. 1, 1952. 40p. (RMO-566)

The identification and occurrences of mineral deposits, a majority of which are found in the Shinarump formation, are listed. Significant finds have been made in the formation above the Todilto in N. Mex. These seem to have a somewhat different mineralization from the well-known deposits in the salt wash formation. For this reason they were studied when the deposits in the Todilto formation near Grants were examined. An inclusion of the uranium minerals found in them up to the present will help in giving a more complete picture of the problems that still face workers in the field and laboratory. Attention is called to "oxidized" and "unoxidized" deposits. The latter contain uraninite and a new black mineral, which the United States Geological Survey has tentatively called coffinite. "Unoxidized" is not synonymous with "hydrothermal." Carbonaceous matter or hydrocarbons are "unoxidized." They possess the power to reduce uranyl solutions or minerals to uranous ones, though obviously igneous activity has no part in this process. Reduction could have occurred at any stage of geologic history whenever uranyl ions reached this favorable environment. (auth)

1427

Geological Survey

FURTHER STUDIES OF THE DISTRIBUTION OF URANIUM IN RICH PHOSPHATE BEDS OF THE PHOSPHORIA FORMATION, by M. E. Thompson. Nov. 1952. 25p. (TEI-275)

Five sets of "close" samples (narrow and contiguous samples across a lithologic unit) from beds of high phosphate content of the Phosphoria formation in Idaho, Utah, and Wyoming were analyzed chemically for F and CO_2. The size of phosphate pellets was measured in thin sections of two sets of close samples. Frequency histograms and cumulative curves were plotted from these size measurements, but when compared with U concentration for each sample, no significant correlation between size and U concentration could be discovered. Analyses of these samples for P_2O_5, CaO, organic matter, and equivalent U were presented in a previous report. In two sets of samples a good correlation was found between equivalent U and each of the other components. The samples in these two sets have a U content that is relatively high (for the Phosphoria formation), and they show considerable variation in P_2O_5 content. (auth)

1428

Geological Survey

TRACE ELEMENTS RESEARCH QUARTERLY PROGRESS REPORT [FOR] APRIL 1 TO JUNE 30, 1952. [nd] 93p. (TEI-280)

Progress on geologic mapping of Monument Valley, Ariz., Monument Valley, Utah; White Canyon, Utah; and Capitol Reef, Utah, is summarized. A previously unknown mineralized area near Oljeto Trading Post, San Juan Co., Utah, is reported, and some U mineralization is reported from Monument Valley, Navajo Co., Ariz. Stratigraphic studies proved that the Shinarump conglomerate of Late Triassic age is fundamentally a basal conglomerate to the Chinle formation of Late Triassic age. Radioactive minerals were found to be moderately abundant in the stock of the North La Sal Mountains. Ground-water and resource studies in Grand and Wayne Cos., Utah, resulted in information on U occurrence. Mapping and stratigraphic studies of the northwest phosphate deposits in Idaho, Wyoming, and Montana and geological studies on the Florida and eastern Gulf of Mexico phosphates are summarized. Work is reviewed, often in the form of abstracts of published papers, on analytical methods for U, Th, and other elements; extraction of Pb from sea water by ion exchange; distribution of U in Montana, Idaho, and California batholith and lava rocks; synthesis of U minerals; crystal structure of montroseite and rare earth carbonates; and ages of Colorado Plateau U ores. (G.Y.)

1429

URANIUM-COPPER DEPOSITS, RUM JUNGLE, AUSTRALIA. C. J. Sullivan and R. S. Matheson. Econ. Geol. 47, 751-8 (1952) Nov.

Uranium mineralization was discovered in association with

copper minerals at Rum Jungle in September, 1949. Investigations carried out since that time, and which are still proceeding, have led to the discovery of additional occurrences, and have shown that the field is likely to prove an important one. The prospects are mainly uranium-copper deposits, but autunite deposits, which are poor in copper, also occur. In addition, radioactivity has been found in a bed of conglomerate over a length of 2.5 miles. No uranium minerals have yet been positively identified from the outcrop of this conglomerate, which shows no sign of sulfide mineralization. This paper presents a preliminary account of the geology and type of mineralization in the Rum Jungle area. (auth)

METALS AND METALLURGY

1430

Atomic Energy Research Establishment, Harwell, Berks (England)

CALCULATION OF THE SHAPE OF THE CONCENTRATION CONTOURS IN GRAIN-BOUNDARY DIFFUSION, by R. T. P. Whipple. July 1952. 22p. (AERE-T/R-1026; HD-782)

Formulas are derived which express the shape of the concentration contours in the grain-boundary diffusion of two different metallic surfaces in contact. Several contours are plotted for various numerical values of the parameters. (L.T.W.)

1431

Oak Ridge National Lab.

MASS TRANSFER IN DYNAMIC LEAD-INCONEL SYSTEMS, by John V. Cathcart. Nov. 14, 1952. 8p. (CF-52-11-116)

Severe mass transfer and corrosive attack were observed in two tests performed with lead-Inconel thermal convection loops. In both tests the hot-leg temperature was 800°C and the cold-leg temperatures were 400 and 475°C, respectively, for the first and second tests. Plugging of the loops occurred after 125 hours in the first test and after 51 hours in the second. Quartz loops with sections of Inconel tubing positioned in the hot and cold legs were substituted for conventional all-metal loops in these tests. This new loop design provided a simple method for deoxidizing the lead with hydrogen, and proved to be very satisfactory for studying mass transfer and corrosive attack in dynamic liquid metal-solid metal systems. (auth)

1432

Armour Research Foundation

REPORT NO. 9 [ON] PHASE DIAGRAMS OF ZIRCONIUM-BASE BINARY ALLOYS FOR OCTOBER 1–DECEMBER 31, 1952; THE ZIRCONIUM-OXYGEN SYSTEM, REPORT NO. 3, by Robert F. Domagala and Donald J. McPherson. Dec. 31, 1952. 7p. (COO-123; Report No. 9; Report No. 3)

The progress of work on determination of the O-Zr binary phase diagram from 0 to 50 at.% is reported. Alloy preparation and a schedule of isothermal annealing treatments are discussed. Chemical analyses data are given. (J.E.D.)

1433

Knolls Atomic Power Lab.

DIMENSION EFFECTS AND THE NATURE OF SLIP IN CARBURIZED IRON SHEET CRYSTALS, by A. N. Holden and F. W. Kunz. Dec. 16, 1952. 35p. (KAPL-841)

Tests on a number of iron single crystals in the form of thin-sheet tensile specimens have shown that the yield point is most pronounced in those crystals in which the dimension in the direction of slip is 200 mils or larger, while those crystals with dimensions in the slip direction of less than 100 mils seldom had any sign of a drop in load. The nature of slip during discontinuous yielding was found to be highly localized and to cause deep grooves which were most pronounced in the specimen surface most nearly normal to the slip direction. (auth)

1434

Metallurgical Project, Mass. Inst. of Tech.

PURIFICATION OF BERYLLIUM BY DIRECTIONAL CRYSTALLIZATION, by C. S. Pearsall. Issued Oct. 29, 1952. 12p. (MIT-1103)

A relatively simple process for the production of high-purity Be metal by directional crystallization from a melt is described. The process may be carried out by withdrawing the melts slowly from a furnace zone and cropping the end containing the concentrated impurities. This operation may be continued until the desired purity is obtained. (J.E.D.)

1435

Metallurgical Project, Mass. Inst. of Tech.

EFFECT OF OXYGEN ON THE DUCTILITY OF BERYLLIUM PREPARED BY HIGH-VACUUM DISTILLATION, by C. S. Pearsall. Issued Dec. 4, 1952. 14p. (MIT-1104)

Several successful Be distillations were carried out at pressures from 5×10^{-8} to 2×10^{-9} mm Hg at temperatures of 1400 to 1500°C. The deposits were generally from 0.010 to 0.040 in. thick and showed well-developed hexagonal crystals under low magnification. All deposits were brittle as indicated by failure in bending. Some of the larger individual crystals were bent under a microscope and again no evidence of improved ductility was indicated. These experiments indicate that no appreciable increase in ductility resulted from lowering the oxygen content of the metal well below 1 ppm. Since the original N content of the metal is also very low, the effect of N is also eliminated. However, these results do not entirely exclude the possibility of ductile Be for appreciable amounts of other impurities still remain even in so-called pure metal. Only after removing these impurities can the effect on the physical properties be ascertained. (auth)

1436

Metallurgical Project, Mass. Inst. of Tech.

OBSERVATIONS ON THE ALPHA-BETA TRANSFORMATION IN ZIRCONIUM, by E. E. Hayes and A. R. Kaufmann. Dec. 16, 1952. 22p. (MIT-1106)

The observable characteristics of the transformation of pure zirconium have been found to differ in two respects from impure zirconium. First, the acicular character of the zirconium microstructure obtained by quenching from above the transformation temperature is absent when the zirconium is sufficiently pure. Second, the impure zirconium exhibits sharp discontinuities in resistivity curves taken during rapid cooling through the transformation range. Although there is no sharp demarcation point in observing these effects as a function of impurity content, a value of about 0.07 to 0.1 wt.% oxygen appears to be necessary to obtain the acicular microstructures and discontinuities in the resistivity curves. (auth)

1437

Utah Univ.

PROGRESS REPORT NUMBER I [ON] THE HIGH TEMPERATURE OXIDATION OF METALS [FOR] DECEMBER 1, 1951 TO FEBRUARY 29, 1952, by W. Martin Fassell, Jr. Mar. 1, 1952. 11p. AND APPENDIX I. THE HIGH PRESSURE OXIDATION RATE OF METALS. I. COPPER IN OXYGEN, by William McKewan and W. Martin Fassell, Jr. [nd] 17p. (NP-4244; Progress Report No. 1)

A general theory has been proposed that will qualitatively account for the shift from parabolic to linear oxidation. Ta has been experimentally shown to oxidize according to the linear law at temperatures in excess of 500°C, a fact previously unknown. Zr oxidizes parabolically at temperatures to 850°C at atmospheric pressure in O_2. It ignites at approximately 860°C which might indicate a shift to the linear mechanism. The oxidation rates of pure Cu

have been determined in the temperature range 600 to 900°C in O_2 from 14.7 to 400 psi total O_2 pressure. The oxidation rates of Cu are unchanged by O_2 pressures within the range studied. In all cases both Cu_2O and CuO are present in the oxide films formed on the Cu metal. (see NP-4245, NP-4246) (auth)

1438

Metallurgical Advisory Committee on Titanium
MINUTES OF CONFERENCE ON CRYSTALLOGRAPHY OF TITANIUM AND ITS ALLOYS [HELD AT] NEW YORK UNIVERSITY [ON] JUNE 27, 1952. June 27, 1952. 22p. (NP-4304)

This report consists of abstracts of 6 papers presented at the Conference on Crystallography of Titanium and Its Alloys. The titles of the papers are Mechanism of Plastic Flow of Titanium, Plastic Deformation in Single Crystals, Directional Properties of Titanium, Preferred Orientation in Titanium, Martensite Formation in Titanium-Manganese Alloys, and Excessive Coarsening in Commercial Purity Titanium. Discussion of each paper is included. (L.T.W.)

1439

Massachusetts Inst. of Tech.
THE MEASUREMENT OF SELF-DIFFUSION COEFFICIENTS BY AUTORADIOGRAPHY, by Harry C. Gatos and Ahmed Azzam. [nd] 8p. (NP-4330)

The applicability of autoradiography to self-diffusion measurements in metals was investigated. Diffusion specimens for testing were prepared by evaporating a thin layer of Au^{198} onto the surface of a Au cylinder in a vacuum apparatus and welding an identical Au cylinder to this face by hot pressing. The specimens thus prepared were diffusion-annealed and sectioned across the interface. The slanted section of the remaining specimen was surface-ground and exposed directly to photographic film. Microdensitometer tracings were obtained for each autoradiogram. Data obtained at 1000°C are presented graphically where the logarithm of the photographic density is plotted versus the square of the corresponding diffusion distance from the interface. The self-diffusion coefficient can be readily computed from the data obtained. An approximate value of 45,000 cal/mole was computed for the activation energy for self-diffusion of Au. (C.R.)

1440

Pittsburgh Univ.
PROGRESS REPORT [ON] THE HEAT CAPACITY OF $MgCd_3$ BETWEEN 12 AND 320°K; THE LOW TEMPERATURE TRANSFORMATION(S) AND THE RESIDUAL ENTROPY OF $MgCd_3$ SUPERLATTICE [FOR] OCTOBER 1, 1952–JANUARY 1, 1953, by R. S. Craig, W. E. Wallace, L. W. Coffer, and C. A. Krier. Jan. 14, 1953. 7p. (NYO-951)

The constant-pressure heat capacity of $MgCd_3$ is reported for temperatures between 12 and 320°K. Using these data, the entropy of formation of $MgCd_3$ at 270°C and the entropies of the pure metals at 25°C previously determined in this laboratory, and published heat capacities between 25 and 270°C, the residual entropy of the $MgCd_3$ superlattice is ascertained to be 0.23 e.u./g atom. This result agrees within the limit of error with the value computed by assuming the Schottky defects which are present at 25°C to 1.7% to be randomly distributed in the alloy at absolute zero. The heat capacities are found to deviate appreciably from the values expected if the Kopp-Neumann rule were obeyed. At least one reversible transformation was observed at temperatures between 180 and 320°K. The transformation is spread over a range of temperature. (auth)

1441

Carnegie Inst. of Tech.
PROGRESS REPORT [FOR] OCTOBER–DECEMBER, 1952, by R. Smoluchowski, C. Coleman, L. Couling, S. Hayes, C. W. Haynes, and Y. Y. Li. Jan. 10, 1953. 5p. (NYO-3484)

Work is continuing on improving the reproducibility of the grain-boundary diffusion results in the Cu-Al system. Angular dependence of grain boundary selfdiffusion in the Fe-Si system is being studied. Further additional points in the study of anisotropy of diffusion in bi-crystals were obtained. Small-angle x-ray scattering in deformed and recrystallized copper has been measured during recrystallization. A camera for work at low temperatures is being constructed. (See NYO-3483) (auth)

1442

Metals Research Lab., Carnegie Inst. of Tech.
ELECTROCHEMICAL STUDIES OF NON-AQUEOUS MELTS; QUARTERLY PROGRESS REPORT [FOR] PERIOD ENDING OCTOBER 1, 1952, by Robert F. Mehl and Gerhard Derge. Dec. 31, 1952. 23p. (NYO-3692)

The electrical conductivity measurements of molten mattes from the liquidus (~1000°) to 1500°C were extended to the entire Cu_2S-FeS composition range. Positive temp. coefficients were found for all but the systems most rich in FeS. There is an abrupt decrease in slope of the specific conductance vs. temp. plot at ~1150°C for compositions near 50-50 wt.%. The electrical conducting properties of pure FeO around 1400°C were determined. Studies were made of the electric conductivity and transport numbers in Fe-silicate slags. The decomposition potentials of $HfCl_4$ and $ZrCl_4$ in LiCl-KCl eutectic were measured at 500°C with solute concentrations of 0.1 to 1 wt.%. (L.M.T.)

1443

Sylvania Electric Products, Inc., Atomic Energy Div.
MECHANICAL PROPERTIES OF ZIRCONIUM, by F. D. Rosi and F. C. Perkins. Issued Dec. 9, 1952. 23p. (SEP-87)

A study was made of the tensile properties of arc-melted Bureau of Mines Grade "A" Zr sponge in the temperature range −196 to 600°C at a constant strain rate of 0.003 min^{-1}. The investigation included experimental data on the nominal stress-strain characteristics, the temperature dependence of yield strength, ultimate strength, fracture strength, elongation, and the elastic modulus. The data indicate the possibility of strain-aging phenomena in the range 300 to 500°C. (auth)

1444

EFFECT OF SURFACE COATINGS ON DEVELOPMENT OF SEIZING IN ALUMINUM. A. P. Semenov. Doklady Akad. Nauk S.S.S.R. 86, 357-9(1952) Sept. 11. (In Russian)

Data on the effects of covering the surface with H_2O, ethanol, heptane, vaseline, oleic acid, and other oils and greases of polar and nonpolar nature on the relation between degree of plastic deformation and appearance of seizing during stamping of Al are reported. (G.Y.)

1445

CRYSTAL SLIP IN ALUMINIUM DURING CREEP. D. McLean. J. Inst. Metals 81, 133-44(1952) Nov.

A study has been made of the types of slip band formed in pure polycrystalline Al undergoing creep strain at 200°C in order to ascertain how much of the total strain was due to each type of slip and to determine the influence of grain size and stress upon the phenomena. Two types of slip band were observed: (i) prominent slip bands of about $\frac{3}{4}$ μ displacement spaced about 30 μ apart on average, and (ii) fine slip lines of about 50 to 500 A displacement and spaced less than 1 μ apart. The former are the slip bands reported by Hanson and Wheeler (J. Inst. Metals 45, 229(1931)) and others. The fine slip lines filled the interspaces between the former. Close examination showed that the prominent bands were simply lamellar regions where this general fine slip had occurred to an unusually large extent, thus producing a prominent step in the surface. Broadly speaking, the number of prominent slip

bands and the mean displacement at these bands increased with increasing grain size and stress. As a result, the strain due to these bands increased considerably with increasing grain size and perhaps slightly with stress. In no case, however, was it more than half the total strain, and it was usually much less. The greater part of the strain was attributable to the fine slip lines. The results are discussed in terms of dislocation theory; the general fine slip accords with the idea of a network of Frank-Read dislocation sources, and the prominent slip bands may be produced by sources, dislocations from which encounter no important obstacles before reaching the grain boundary, for such sources should emit many dislocations. (auth)

TRACER APPLICATIONS

1446

Naval School of Aviation Medicine, Pensacola

SURFACE DIFFUSION OF RADIOACTIVE MONOLAYERS AND A NEW METHOD OF DETECTING ACTIVE PATCHES AND SURFACE CRACKS, by Dietrich E. Beischer. Dec. 29, 1951. 21p. (NP-4299; U-21226)

The diffusion coefficient of stearic acid on mica was determined by radioautographic techniques at temperatures between 50 and 80°. Radioactive monolayers were plated on the mica sheets which were pretreated by either scratching with a needle, rinsing in 0.001M $Al(NO_3)_3$, or marking with a fingerprint. The plates were then heated to initiate diffusion of the layer. The amount of chemically bound stearic acid was determined by dipping a part of each plate into C_6H_6. The diffusion of the acid molecules showed a preferred adsorption wherever they were chemically bound. The molecules accumulated in the scratches, making the scratches easily detectable. The velocity of diffusion was dependent on temperature, the rate approximating that which occurs inside a liquid phase. The activation energy was calculated to be 8.6 kcal/g atom. (TID-LC)

1447

AUTORADIOGRAPHY OF METAL SURFACES USING A RADIOCHEMICAL METHOD. E. Rabinowicz. Nature 170, 1029-30(1952) Dec. 13.

The different chemical reactivities of the various metal surface components toward some labeled substance that forms a localized radioactive product can be used as a surface-autoradiographic technique. The method is illustrated by application of I^{131}- labeled amyl iodide to numerous metals, the number of atomic layers formed by reaction of the iodine with the metal being determined. A surface autoradiograph of a steel surface showing location of Cu fragments transferred during sliding is shown. Good resolution and flexibility feature the method. (G.Y.)

1448

RADIOISOTOPES IN THE STUDY OF METAL SURFACE REACTIONS IN SOLUTIONS. Massoud T. Simnad. Inst. Metals (London), Mongraph and Rep. Ser. No. 13, 23-54 (1952).

A survey is made of studies with radioisotopes having a bearing on metal surface reactions in solutions. The results of some recent unpublished work are introduced, at appropriate points, as examples of present trends in the application of radioisotopes in this field. The chief characteristics of radioisotopes, their advantages and limitations in tracer work, and the effect of radiation on matter are first discussed. The exchange between metals and ions in solution is dealt with at length; previous experiments and explanations are criticized, and from the results of recent experiments several generalizations are made regarding the mechanism of this phenomenon. The passivating action of chromates has been studied with the aid of tagged chromate ions in solution and the results are shown to corroborate the film theory of Hoar and Evans (J. Chem. Soc., 2476(1932). Self-diffusion and isotopic exchange in surface films and aqueous solutions are discussed in view of their important part in governing the behavior of metals in solutions. The identification and location of surface inhomogeneities in metals, by activation analysis and by intentional addition of radioisotopes, is described. Finally, radiotracer studies of the deposition of traces of ions on to metal surfaces are summarized. 195 references. (auth)

PHYSICS

1449

Ohio State Univ.

SOME PROPERTIES OF SUPERCONDUCTORS BELOW 1°K. III, by T. S. Smith, W. B. Gager, and J. G. Daunt. [nd] 3p. (AECU-2239(add.))

The transition temperature of a sample of crystal bar iodide Ti of 99.99% purity was found to be 0.387°curie, and the slope of the magnetic threshold curve at the curie point was found to be 89.5 gauss/°curie. The magnetic threshold curve is approximately parabolic and indicates a magnetic threshold field value at 0°K of 20 gauss. On the assumption that the measured magnetic threshold curve for Ti represents an equilibrium boundary between superconducting and normal states, the specific heat of the electrons in the normal state is found to be 1.1×10^{-4} T cal/deg-mole. (L.T.W.)

1450

Atomic Energy Research Establishment, Harwell, Berks (England)

A STUDY OF MONO-LAYER ADSORPTION OF TWO SPECIES ON NON-UNIFORM SURFACES, by E. Glueckauf. Aug. 1952. 40p. (AERE-C/R-999)

The isotherms for the mixed monolayer adsorption of two species are discussed for a surface containing sites of all positive adsorption energies, such that the number of sites falls off exponentially with their energy. Under these conditions the partial isotherms are of two types according to the mean adsorption energies of the species on a fully covered surface. The spreading pressure, the differential molar heats of adsorption, and the entropies were calculated for the adsorbates both singly and in mixtures. (L.T.W.)

1451

Atomic Energy Research Establishment, Harwell, Berks (England)

IONIC CURRENTS IN THIN FILMS OF ZIRCONIUM OXIDE, by A. Charlesby. Sept. 23, 1952. 25p. (AERE-M/R-1014)

The electrical properties of thin oxide films on Zr formed by anodizing in suitable electrolytes have been studied. Optical methods show the film to be uniform in structure, and both optical and capacity measurements have been used to measure its thickness. At room temperature this is found to be proportional to the formation voltage and to depend to a much lesser extent on the formation current. Owing to the uncertainty in the dielectric constant, a reliable value for the film thickness per unit of formation voltage cannot be given. The results obtained are consistent with the following relation between ion current i_+ and electrostatic field across the film: $i_+ = A_+ \exp B_+F$, where A_+ and B_+ are constant at room temperature. From the approximate value of B_+ and the variation of A_+ with temperature it is deduced that the barrier opposing ionic flow from the metal has a width of 1.3 or 2.1 A, and a height of the order of 1 ev. The

effect of varying the type of electrolyte used has been studied. Certain electrolytes, e.g., dilute sulfuric acid, which give a porous conducting oxide film on Al produce insulating films on Zr. On the other hand, electrolytes which produce insulating oxide films on Al also do so on Zr. (auth)

1452

Atomic Energy Research Establishment, Harwell, Berks (England)

ELECTRON AND PHOTOCURRENTS IN THIN FILMS OF ZIRCONIUM OXIDE, by A. Charlesby. Sept. 23, 1952. 10p. (AERE-M/R-1015)

In a previous report (AERE-M/R-1014) the formation of thin oxide layers of Zr by electrolytic means has been discussed. This report deals with certain related phenomena, namely, the flow of electron and photoelectric currents when electrostatic fields are applied across the film. At electric fields insufficient to produce appreciable ionic flow, an electron current i_- is observed which depends on the field strength F: $i_- = 2A_- \sinh B_-F$, where A_- and B_- vary with temperature: $A_- = A_0 \exp(-U/kT)$ and $B_- = ae/kT$. A physical interpretation of this phenomenon is that the applied field helps the electrons to surmount an energy barrier of height U and half width a. The values U and a are 0.375 ev and 2.3 or 3.6 A, depending on the value chosen for the dielectric constant. A phenomenon of aging is observed. An oxide film kept at voltage for long periods shows a marked reduction in the value of A_-. Possible reasons for this aging phenomenon are discussed. Photocurrents through the film are observed when ultraviolet light falls on it. The relation between the photocurrent i_p and the field F is similar to that observed for the (dark) electron current but with different values of the constants: U = 0.15 ev, and a = 1.25 or 2 A. No aging effect is observed in the photocurrent. (auth)

1453

Brookhaven National Lab.

THE MAGNETIC PROPERTIES OF SOME ANHYDROUS CHLORIDES, by Norman Elliott. [nd] 6p. (BNL-1318)

The magnetic susceptibility of $CoCl_2$ and of solid solutions of $CoCl_2$ with $ZnCl_2$ and $CdCl_2$ have been measured over the temperature range 76 to 296°K. The susceptibility of $CoCl_2$ is very little affected by dilution with isomorphous chlorides. The results are interpreted as showing that $CoCl_2$ deviates from Curie's law in its behavior because of a crystalline-field Stark effect rather than Heisenberg spin-spin exchange. (auth)

1454

Naval School of Aviation Medicine, Pensacola

MELTING PHENOMENA OF A SURFACE OF MONOMOLECULAR THICKNESS, by Dietrich E. Beischer. Feb. 1, 1952. 5p. (NM-001 059.16.08)

The direct observation of the phase transition of a monolayer of stearic acid in radioautographs confirms many earlier observations of the melting phenomena of a surface. The surface has no sharp melting point and the transition order-disorder takes place at a considerably lower temperature than in the bulk phase. (auth)

1455

Oak Ridge National Lab.

PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1952. Issued Jan. 9, 1953. 36p. (ORNL-1365)

The N^{14} neutron total cross section was extended from 1.7 to 4.0 Mev by use of the $H^3(p,n)He^3$ neutron source. Five resonances were resolved in this interval. Total average neutron cross sections of Ge, Se, Cd, and Hg were measured from 0.4 to 3.5 Mev. The energy spectrum of particles from the reactions $He^3(Li^6,Li^5)He^4$ and $He^3(Li^6,Be^8)H^1$ was observed, and an excited state of Be^8 at 2.05 Mev above the ground state was found. Absorption of 4 monoenergetic γ rays in Pb and Al is reported. The decay scheme of Hf^{181} and a Ge isomer of half life ~0.35 sec are reported. Electric resistivity as a function of temperature was measured in high-purity Zr from 14 to 300°K. UF_3 was found to be paramagnetic in the liquid-He temperature region. The neutron transmission cross sections of powdered Ni and NiO were measured in the very low-energy range. The coherent cross sections and energy dependence of the thermal diffuse scattering were determined. (See ORNL-1289) (L.T.W.)

COSMIC RADIATION

1456

NUCLEAR INTERACTION OF HIGH-ENERGY PROTONS. A. Dadayan. Doklady Akad. Nauk S.S.S.R. 86, 683-6(1952) Oct. 1. (In Russian)

Cross sections for interactions of cosmic protons having energies of 0.4×10^9 to 2.5×10^9 ev with carbon nuclei have been determined with a large magnetic spectrometer mounted at 3200 m altitude. (G.Y.)

1457

ANGULAR DISTRIBUTION, MOMENTUM SPECTRUM, AND EAST-WEST DISSYMMETRY OF THE NUCLEAR COMPONENT OF COSMIC RADIATION STUDIED WITH SENSITIVE EMULSION. Max Morand and Tsai-Chü. Compt. rend. 235, 1502-4(1952) Dec. 10. (In French)

The directional intensity distribution of nonrelativistic tracks, corresponding to protons of less than 230 Mev energy, in Ilford G5 emulsion exposed at Tamanrasset, Algeria, could be represented by $I = I_0 \cos^{\lambda} \alpha$, where $\lambda = 2.56 \pm 0.28$ for α, the angle that the track projection on the plane of the emulsion makes with the vertical, $<60°$. The vertical intensity was $1.625 \pm 0.072 \times 10^{-4}$/cm²/sec/steradian. The differential momentum spectrum for <1 bev/c protons is sketched, and the existence of an east-west dissymmetry is confirmed. (G.Y.)

1458

ABSORPTION OF THE NUCLEON COMPONENTS OF COSMIC RADIATION AT −21° GEOMAGNETIC LATITUDE. Juan G. Roederer. Z. Naturforsch. a7, 765-71(1952) Dec. (In German)

The altitude dependence of the star-producing components was investigated with Ilford G5 emulsion at 21° S geomagnetic latitude (Tucumán province, Argentina). A rule is proposed by which energy spectra can be derived from the star-magnitude diagram. This is applied to determination of the absorption length in various energy intervals. The latitude effect relative to results in 48° N geomagnetic latitude is discussed. (tr-auth)

1459

NEUTRON PRODUCTION IN LEAD BY COSMIC RADIATION. K. Hogrebe. Z. Naturforsch. a7, 772-80(1952) Dec. (In German)

Neutron production by cosmic rays in Pb up to 31 cm thick was measured with a BF_3 counter of special construction. The results in general show a smooth trend for the integral neutron-production curves for the total, as well as for the ionizing, neutron-producing radiations, corresponding to exponential decreases of these radiations with mean free paths of 320 ± 35 and 480 ± 120 g/cm². Of the total neutron production in Pb, $18.5 \pm 1\%$ was caused by charged particles. In agreement with a rough estimation, it is shown that a possible transition effect at ~2 cm of Pb, arising from (γ,n) processes of the weak component, lies within the experimental accuracy. A slight effect appeared at 20 cm of Pb, probably of the same origin as the maximum for star frequency found by Schopper (NSA 5-5727, 6-2405) at this depth. (tr-auth)

1460

EFFECT OF EQUATORIAL RING CURRENT ON COSMIC-RAY INTENSITY. S. B. Treiman. Phys. Rev. 89, 130-3 (1953) Jan. 1.

The equatorial-ring current postulated by Chapman and Ferraro (Terr. Mag. Atmos. Elec. 45, 245(1940)) to explain the main phase of terrestrial magnetic storms is analyzed with respect to its effect on the intensity of the cosmic radiation. For mathematical convenience, the ring current is replaced by a current sheet located on the surface of a sphere concentric with the earth, in accordance with a suggestion due to Chapman (Nature 140, 423(1937)). A simple expression is then obtained relating the variations in magnetic field at the equator with the corresponding variations to be expected in the intensity of cosmic radiation measured by an arbitrary detector located at any latitude and atmospheric depth. (auth)

1461

DIURNAL VARIATIONS IN THE INTENSITY OF COSMIC RAYS UNDERGROUND. Noah Sherman. Phys. Rev. 89, 25-6(1953) Jan. 1.

The number of coincidences between two trays of Geiger counters located at a depth of 8.46×10^4 g/cm^2 underground was recorded each hour, and these data were analyzed for variation of cosmic-ray intensity with solar and sidereal time. A total of 7.4×10^5 μ mesons was observed whose average energy is estimated to be 2×10^{11} ev. In each case the standard deviation of the observed coincidence rates from the mean rate is not larger than the standard deviation expected from a normal distribution. The first-harmonic amplitudes of the solar and sidereal variations indicate that the data are equally consistent with an assumed daily sinusoidal variation in the coincidence rates of ~0.5% and with the absence of such variation. The difficulties involved in deducing directional properties of the primary cosmic radiation from harmonic analysis of variations in secondary radiation underground are discussed. (auth)

1462

RATIO OF NUMBER OF MESONS TO NUMBER OF HEAVY PARTICLES REGISTERED IN NUCLEAR EMULSION EXPOSED ON THE PUY DE DOME. Simone Desprez-Rebaud. Compt. rend. 235, 1386-8(1952) Dec. 1. (In French)

In plates exposed at Puy de Dôme observatory while oriented with respect to the sun (cf. NSA 6-6084) and in which proton energies were limited to 120 Mev, the author has identified 18 mesons to 909 heavy particles, a proportion of about 2%. (tr-auth)

ELECTRICAL DISCHARGE

1463

Atomic Energy Research Establishment, Harwell, Berks (England)

THE IONIZATION BY ELECTRON IMPACT OF EXCITED HYDROGEN ATOMS, by F. Mandl. Aug. 1952. 13p. (AERE-T/R-1006)

The cross section for the ionization of atomic hydrogen in 2s and 2p states, by electron impact, is calculated. For the (2p,m = ±1) excited states the numerical computation has been carried out and a cross section vs. energy curve has been obtained. The calculation employs first-order perturbation theory, the ejected atomic electron being described by a Coulomb wave function, the bombarding electron, before and after collision, by plane waves. Hence, this calculation is expected only to be valid for large energies. This is also required in order to justify the fact that the interaction of the two electrons, apart from it causing a first-order transition, and the possibility of electron exchange are neglected. On account of these approximations much confidence cannot be placed in the energy vs. cross section curve at moderate energies. Comparison with the cross section for the ground state and the classical formula of J. J. Thomson however, suggests that the cross section is appreciably larger (by about a factor 10) for the (2p,m = ±1) states than for the ground state. (auth)

INSTRUMENTS

1464

Atomic Energy Research Establishment, Harwell, Berks (England)

ACCURACY LIMITATIONS IN DETERMINATIONS OF PARTICLE ENERGIES AND VECTOR MOMENTA IN NUCLEAR EMULSIONS, by J. J. Wilkins. Sept. 23, 1952. 24p. (AERE-G/R-1020; HD-771)

A study is made of sources of error in measurements on α particles (≤40 Mev) and protons (≤10 Mev) in Ilford C2 and E1 nuclear emulsions. Observations on range straggling reported in the literature are reviewed and their significance is clarified. Typical errors introduced by techniques of track measurement and by the limited resolving power of the emulsions are assessed by a detailed analysis of some measurements on $C^{12}(\gamma,3\alpha)$ photodisintegration stars in E1 emulsions. The accuracy achieved in these measurements is studied as a function of the dip angle of the star tracks, enabling the effects of different errors to be separated to a considerable extent. For example it is shown that range straggling amounted to ~ ±0.9 μ fluctuation (standard deviation) in range, and that depth measurements were subject to ~ ±0.3 μ uncertainty. Finally, the conclusions of the paper are presented in convenient graphical forms, showing the accuracy to be expected in determinations of energy and vector momentum values. (auth)

1465

Argonne National Lab.

AN INDUCTION HEATED HIGH TEMPERATURE X-RAY DIFFRACTION CAMERA, by Melvin H. Mueller and Daniel D. Zauberis. Oct. 22, 1952. 8p. (ANL-FF-306a; UAC-673)

A high-temperature x-ray-diffraction camera is described in which the sample is heated indirectly by induction in a vacuum or atmosphere. The sample may be in the form of small solid rod, extruded compact, or powder enclosed in a thin-walled capillary. Small thin-walled tubing, such as Ta, is used as a heater. The cylindrical film is held in an external cassette which may be removed without disturbing the vacuum or atmosphere surrounding the sample. The temperature of the sample is held constant to at least ±0.2% by means of a thermocouple placed in the eddy current field. The emf output of the thermocouple is used in an electronic servo loop to control the r-f power to the work coil. (auth)

1466

Office of Basic Instrumentation, National Bureau of Standards

A PHASE-SAMPLING TELEMETER, by M. G. Pawley and J. O. Dick. Sept. 29, 1952. 25p. (NBS-2020)

A phase-sampling telemeter incorporating a transmitting unit with only one miniature tube envelope exclusive of the radio transmitter required in some operations is described. The extreme simplicity of the transmitting unit is gained at the expense of channel frequency response and relative complexity in the channel decoding circuitry in the receiving set. By utilizing continuously rotatable phase shifters in the channel phase modulators, it is possible to transmit continuous rotational information simultaneously in a number of channels. It is thus possible to provide remote, continuously rotatable dial or pointer indication of shaft positions occurring at the transmitting location. It is equally feasible to use the device for simultaneous accurate control or positioning of a number of remote shafts. Servo power amplification can readily be added. The speed of response

in this application is limited by the relatively slow speed of commutation utilized, but the accuracy of remote positioning control is limited principally by the design of the rotatable phase shifters used. (L.T.W.)

1467
Office of Basic Instrumentation, National Bureau of Standards
A STUDY OF THE PERFORMANCE OF PHOTOMULTIPLIERS OPERATED AT HIGH VOLTAGE, by Ben Petree and Frank Viera, Jr. Nov. 17, 1952. 24p. (NBS-2065)

A study has been made of the performance of type 931-A photomultipliers when the voltage is applied to the electrodes in pulses of a few μsec duration. It was found that selected tubes can be operated without breakdown at pulsed voltages as high as about 2500 v, which is twice the rated d-c value. Greater amplification and output current are obtained as a result of the increased voltage. The amplification is increased by a factor of 40, while the output current and useful speed of response are increased by a factor of ten. (auth)

1468
REPRODUCTION OF VOLTAGE PULSES THROUGH A PROPORTIONAL AMPLIFIER; OPERATING PROPERTIES AND DIMENSIONS OF AN AMPLIFIER FOR NUCLEAR PHYSICS INVESTIGATIONS. U. Cappeller. Z. angew. Physik 4, 330-43(1952) Sept. (In German)

Reproduction of voltage pulses through a proportional amplifier is treated mathematically with the aid of Laplace transforms. As examples, the transfer functions of single- and multistage amplifiers are derived. (G.Y.)

ISOTOPES

1469
ASSIGNMENT OF MASS NUMBER 188 TO THE 18-MIN RHENIUM ISOMER BY CHEMICAL MEANS. Wilfrid Herr. Z. Naturforsch. a7, 819-20(1952) Dec. (In German)

K_2ReCl_6 was irradiated with slow neutrons in a quartz ampoule, which was then heated briefly to 540°C. The contents were than dissolved in 10% H_2SO_4, some Re(VII) was added as carrier, and the solution was allowed to stand 1.75 hr for the 18-min isomer to decay. The Re(VII) fraction was precipitated with H_2S and counted. A pure 17-hr decay was found, indicating that the 18-min isomer is Re^{188m} and decays directly to the ground state of Re^{188} (G.Y.)

1470
ISOTOPES. Jacob Bigeleisen. Ann. Rev. Phys. Chem. 3, 39-56(1952)

This literature review for the calendar year 1951 covers the general field of the chemistry of isotopes, i.e., studies of the physical state and chemical properties of matter affected by the nuclear mass. The phases discussed are mass measurements, abundances, separation, effects on phase equilibria, effects in chemical equilibria, effects in chemical kinetics, effects on mass spectra, and shifts in atomic and molecular spectra. 129 references. (L.M.T.)

MATHEMATICS

1471
Chalk River Project (Canada)
COULOMB FUNCTIONS FOR LARGE VALUES OF THE PARAMETER η, by T. D. Newton. Dec. 1, 1952. 10p. (CRT-526)

Two relations for the coulomb function are derived for the cases $p > 2n$ and $p < 2n$, where $p = r\sqrt{2\mu E}/\hbar$ in the radial wave equation for a coulomb field, and $\eta = (zz' e^2/\hbar)\sqrt{\mu/2E}$ in the wave equation. Values of the coulomb function for values of η between 10 and 200 are tabulated and are compared to the values obtained by Barfield and Broyles (Phys. Rev. 88, 892(1952)). (L.T.W.)

MEASURING INSTRUMENTS AND TECHNIQUES

1472
Atomic Energy Research Establishment, Harwell, Berks (England)
A TRANSPORTABLE RADIOACTIVITY MONITORING EQUIPMENT USED FOR GEOLOGICAL SURVEYING BY CAR, by D. H. Peirson. Oct. 5, 1951. 17p. (AERE-EL/R-750; HDS-230)

A sensitive G-M equipment has been designed to measure variations in gamma-ray intensity. Use as a mobile detector in radioactivity surveying by car is described. Robustness and reliability are achieved by the use of cold cathode tubes in the ratemeter and alarm circuits. Provision is made for the continuous recording of the background counting rate; a record of a long range radioactivity survey is discussed. The equipment has been designed for use under extreme climatic conditions and may be operated from a 6-v battery. (auth)

1473
Atomic Energy Research Establishment, Harwell, Berks (England)
ABSOLUTE NEUTRON DENSITY DETERMINATIONS USING COBALT, by D. J. Littler and R. H. Thomas. Sept. 16, 1952. 8p. (AERE-R/R-1019)

The report describes how Co wire may be used for the absolute integration of thermal neutron density over any period of time up to several years. Thermal neutron densities in BEPO have been measured by irradiating together Co wires and Na_2CO_3. The absolute values of the thermal neutron densities as determined by the two methods agree to ±4%. (auth)

1474
Office of Basic Instrumentation, National Bureau of Standards
AN EVALUATION STUDY OF A FAST-NEUTRON SPECTROMETER BASED ON THE TOTAL ABSORPTION PRINCIPLE, by Marshall R. Cleland. Oct. 27, 1952. 44p. (NBS-2036)

The Monte Carlo sampling procedure has been used to evaluate a proposed spectrometer for neutrons with energies above 1.0 Mev. The instrument employs a cylindrical phosphor 5 cm in diameter and 5 cm long composed of a half-and-half mixture of phenylcyclohexane and methyl borate activated with 3 to 5 g of p-terphenyl and 10 to 15 mg of diphenylhexatriene per kg of phosphor. The total light output pulse which results from recoil charged particles indicates the neutron energy and is observed with a photomultiplier tube. It was arranged to record only those events in which the neutron is first thermalized by elastic collisions and then captured by boron. The capture criterion with the small volume scintillator strongly favors neutrons that lose most of their energy at the first collision and leads to good energy resolution. The efficiency for the borated scintillator is shown to be 0.15% and the energy resolution about 10% for 14.0 Mev neutrons. The mean time interval between the recoil proton pulse and the boron capture pulse is shown to be 2.0 μsec with 18.8% B^{10} in the methyl borate. A brief summary of other neutron spectrometers and calculations for an infinite volume scintillator also are presented. (auth)

1475
Radiation Physics Lab., National Bureau of Standards
COBALT 60 RANGE FOR THE CALIBRATION OF DOSE AND DOSE RATE METERS, by Giles E. Brown. Dec. 2, 1952. 40p. (NBS-2091)

A Co^{60} calibrating range has been developed by NBS for the calibration of dose-rate meters with ranges varying from 0.5 mr/hr to 500 r/hr in length and for the calibration of dose meters capable of measuring as little as 200

mr or as much as 500 r. A source holder was built to accomodate a 9-c source of Co^{60}, and means were devised for raising the source 70 cm above the top of the holder for the calibration of high-reading meters. Intermediate-range meters are calibrated by attenuating the radiation through 9.2 cm of Pb and low-reading meters are calibrated by using the radiation leakage through the side of the source holder. Complete descriptions are given of the source holder, the system for raising the Co^{60} source, a pneumatic handling tool, the calibration of the Co^{60} source, and calibration of the calibrating range. Data are given for some preliminary measurements that have been made. (L.M.T.)

1476

Radiation Physics Lab., National Bureau of Standards
CALIBRATION STUDY OF TRACERLAB MODEL SU-13 RADIACMETER, by T. P. Loftus. Dec. 22, 1952. 6p. (NBS-2122)

The calibration of this ionization-chamber type survey meter which reads over the 0.025 to 500 r/hr range is discussed. The calibration was made with Co^{60} γ rays normal to the front end of the meter and of sufficient intensity to produce a reading at each of its scale markings. Results show that the instrument reads 200 to 300% too high at the high end of the scale, and too low at the low end. Battery-life tests show that adjustment is impossible beyond 12 hours. (L.M.T.)

1477

Atomic Energy Project, Univ. of Calif., Los Angeles
SHOCK WAVE PRESSURE MEASUREMENTS BY A VELOCITY COMPARISON METHOD, by Brian Dunne and Benedict Cassen. Issued Nov. 10, 1952. 13p. (UCLA-233)

Shock-wave pressures are measured by comparing the distances traversed in a given time interval by the principal shock and a "weak" shock generated by the principal shock. A simple calculation based upon the Rankine-Hugoniot relation determines the correction to the Mach number of the weak shock to obtain the Mach number of the principal shock. The use of this value in the Rankine-Hugoniot relation enables the shock-front pressure to be calculated within an estimated accuracy of 2%. (auth)

1478

Radiation Lab., Univ. of Calif., Berkeley
CALCULATION OF GEOMETRICAL EFFICIENCY OF COUNTERS, by Louis R. Henrich. Aug. 8, 1952. 12p. (UCRL-1954)

With R_2 the radius of the source and R_1 the radius of the counter, the geometrical efficiency is calculated for both point and circular sources for $R_1 > R_2$ and $R_1 < R_2$. (L.M.T.)

1479

SELF-QUENCHING PARALLEL-PLATE VAPOR COUNTER AT VOLTAGES BELOW THE STATIC BREAKDOWN FIELD STRENGTH. Jens Christiansen. Z. angew. Physik 4, 326-9 (1952) Sept. (In German)

If a parallel-plate counter is operated below static breakdown voltages, Townsend avalanches released by primary ionization can be detected by the use of a suitable wide-band amplifier. Use of various pure vapors, e.g., methylal or ethanol, permits every ionizing event to be counted within a voltage range of 100 v. (G.Y.)

1480

A β-SPECTRO-GONIOMETER FOR COINCIDENCE AND ANGULAR CORRELATION MEASUREMENTS. DESIGN AND APPLICATIONS. Kai Siegbahn. Arkiv Fysik 4, 223-71(1952)

Description is given of the design and applications of a two-channel e-β or e-e coincidence spectrometer (β spectrogoniometer), designed especially for measuring angular correlations between emitted electrons. Electron scattering in the surroundings, often a difficulty in angular correlation measurements, is virtually eliminated in this instrument. The angular correlation between internally created positrons and electrons in Na^{24} is examined and the results indicate that the instrument performs well in complex radiations. Revised decay schemes have been proposed for Ga^{67}, Au^{199}, and Sm^{153} from spectral measurements with the instrument. The most recent decay scheme of Tm^{170} was confirmed. The angular correlation between the F line and the continuous spectrum of ThB was studied, the angular distribution being found isotropic within experimental limits. (L.M.T.)

1481

DETERMINATION OF THE SELF-ABSORPTION AND RELATIVE EFFICIENCY OF SOME IMPORTANT LIQUID SCINTILLATORS. Holger Sköldborn. Arkiv Fysik 4, 207-15(1952).

The absorption properties and relative efficiency of several liquids were studied, the aim being to find a liquid, either pure or mixed, which would give pulses strong enough so that it could be used to replace the crystal of a scintillation counter. Of the several liquids studied, xylene and dimethyl aniline proved to be most effective pure liquids, and anthracene in xylene gave the best results of the two-component systems. The absorption coefficients at given depth of the solution and relative efficiency of the liquids studied are given in the data. (L.M.T.)

1482

QUANTITATIVE MEASUREMENTS OF LOW DOSE-RATE ROENTGEN RAYS IN TERMS OF THE INTERNATIONAL r-UNIT BY CLOSED IONIZATION CHAMBERS. R. Thoraeus. Arkiv Fysik 4, 353-61(1952).

A brief survey is given of the roentgen standard laboratory outfit designed and installed by the author. In particular it discusses the use of closed ionization chambers for quantitative measurements of low dose-rate x rays in terms of the international r-unit, and describes the design and properties of some chamber units, one of them having a sufficiently high sensitivity to allow measurements of the radiation behind ordinary protective barriers at exposure times of only a few minutes. The direction independence of this chamber is fairly good, and its wavelength independence is wide enough to cover all qualities of radiation met with in ordinary x-ray therapy and diagnostics within a measuring accuracy of about + 3.5%. Finally the value of wearing measuring instruments in radiological work to check the amount of radiation received by individual workers is discussed, and in addition an improved method of arranging the instruments is described. (auth)

1483

THE PHOSPHOR-PHOTOTUBE RADIATION DETECTOR. D. P. Cole, P. A. Duffy, M. E. Haves, W. S. Lusby, and E. L. Webb. Elec. Eng. 71, 935-9(1952) Oct.

The development of a light portable survey instrument, the phosphor-phototube radiation detector, is described. The detector utilizes the average current from the phototube rather than pulses as from the scintillation detector. The main phosphor is anthracene and a small amount of $CdWO_4$ crystals are added to the distal surface of the anthracene. The instrument is stable, responds rapidly, can be zeroed and calibrated in a radiation field, and covers the range from approximately 0.05 to 500 r/hr in four linear decades. (L.M.T.)

1484

USE OF ROSENBLUM COUNTER WITH VERY-SHORT-DELAY COINCIDENCE SELECTORS. Théo Muller, Raymond Richert, and Serge Gorodetzky. Compt. rend. 235, 1385-6 (1952) Dec. 1. (In French)

When a Rosenblum spark counter was operated in conjunction with a high-speed Bay coincidence selector (NSA 5-5817), the resolution time for the entire circuit was 10^{-10} sec. This low figure is contrasted with the finding by Conor (NSA 5-

4822) of $<10^{-7}$ sec for the activation time of the Rosenblum counter and Bay's estimation of 3×10^{-10} sec for the resolution time of his selector. (G.Y.)

1485

NEUTRON DETECTION WITH TRIMETHYLBORON AND INVESTIGATION OF THE $B^{10}(n,\alpha)Li^7$ REACTION. Ulrich Hermann Hauser. Z. Naturforsch. a7, 781-5(1952) Dec. (In German)

The gas trimethylboron, which is slow to react in comparison with BF_3, is particularly suited to detection of thermal neutrons. It permits application of high pressure and results in high response probabilities therewith. Properties of trimethylboron proportional counters are described. These show no changes over many months. The energies of the $B^{10}(n,\alpha)Li^7$ reactions were determined with a proportional counter filled with an argon-trimethylboron mixture and a pulse analyzer. The results agree with those found indirectly by Lauritsen et al. only if a relation between the mean energy loss per ion pair in argon and the energy of the slow α or Li recoil particles is assumed that is disputed by other authors. The reaction energies found were 2.304 ± 0.025 and 2.781 ± 0.025 Mev. The probability for transition to the ground state of Li^7 equals 5.8 ± 0.1%. (tr-auth)

MESONS

1486

Radiation Lab., Univ. of Calif., Berkeley

THE SCATTERING AND ABSORPTION OF POSITIVE PI MESONS BY ALUMINUM (thesis), by James Frueh Tracy. Nov. 16, 1952. 73p. (UCRL-2013)

The interaction of π^+ mesons with Al has been studied by using a cloud chamber containing five $\frac{1}{8}$-in. Al plates in a 5200-gauss field. Meson energies ranged from 25 to 100 Mev (average, 49 Mev). μ^+ contamination was 13%. Positron contamination was negligible. Twenty stops, 34 scatters ≥30°, and 57 stars were observed. All stops are reasonably accounted for by scatters and stars hidden by the geometry. One event interpreted as an inelastic charge exchange scatter was observed. It consisted of a 1-prong star and a 70-Mev electron-positron pair in coincidence. The cross sections rise steeply with energy. The scattering (elastic plus inelastic) is very roughly isotropic except for a dip in the 60 to 90° interval and possibly for one in the 120 to 150° interval. Corrected absolute cross sections for the 25 to 45, 45 to 70, and 70 to 100 Mev intervals, respectively, are: σ(scat), 70 ± 23, 312 ± 74, and 216 ± 82 mb; σ(star), 176 ± 37, 299 ± 62, and 332 ± 100 mb; and σ(total), 246 ± 43, 611 ± 95, and 548 ± 129 mb. Detailed results, with a discussion of errors and a description of experimental apparatus and procedures, are given. (auth)

1487

BOUND STATES BETWEEN NUCLECN AND ANTINUCLEON. Gernot Eder. Z. Physik 132, 330-4(1952). (In German)

The question of existence of bound states between nucleon and antinucleon coupled by a meson field is considered for relativistic energies. This has been accomplished by the discovery of energy eigenvalues of the Bethe-Salpeter equation. Scalar and pseudoscalar theories do not lead to bound states, but a reactor coupling yields an energy eigenvalue. The latter should be applicable in interpreting heavy mesons as nucleon-antinucleon systems. (tr-auth)

1488

SPECTRUM OF μ-MESOHYDROGEN. A. D. Galanin and I. Ya. Pomeranchuk. Doklady Akad. Nauk S.S.S.R. 86, 251-3(1952) Sept. 11. (In Russian)

Expressions for potential and energy differences of levels of hydrogen-like μ-mesic atoms are derived, and the variation of ground state with Z is discussed. (G.Y.)

1489

THE DECAY OF V^0 PARTICLES. R. B. Leighton, S. D. Wanlass, and C. D. Anderson. Phys. Rev. 89, 148-67(1953) Jan. 1.

In a set of 23,000 cloud-chamber photographs taken in a study of penetrating showers, 134 examples of the decay of neutral V particles, and 18 of the decay of charged V particles, were observed. An analysis of the 152 examples leads to the following principal conclusions: (1) V particles result from the impact of mesons and probably also of nucleons, upon nuclei. (2) V particles are generally produced singly and not in pairs. (3) Two independent kinds of data, one based on measurements of angles and other purely spatial relationships, and the other based on measurements of momentum and specific ionization, lead to the conclusion that more than 80% of these neutral V particles decayed by the production of a heavy positive and a light negative particle. The mass of the heavy positive particle in most instances was consistent with that of a proton, but in a few cases may have been somewhat less. The negative particle appeared most often to be a π meson, although in a few cases a μ meson was indicated. In about 7% of the cases, the positive particle was light and had a mass consistent with that of a π or μ meson. In these cases the mass of the negative particle was not well determined. So far, therefore, in these investigations, there is no direct evidence that a neutral V particle decays into two π mesons, or into a positive π meson and a negatively charged proton, although a few cases may be so interpreted. (4) The data are consistent with the assumption of a two-body decay for a majority of the neutral V particles, and therefore a rather extensive analysis is given based upon this assumption. (5) The energy release, or Q value, of the decay of neutral V particles was computed, on the assumption of a two-body decay, for those cases in which the production of a heavy positive particle was clearly indicated, and where momentum measurements were possible. (auth)

1490

EXPERIMENTAL VERIFICATION OF THEORIES OF THE IONIZATION PRODUCED IN GAS BY HIGH-ENERGY MESONS. Paul Chanson, Pierre Treille, Terrence Price, and David West. Compt. rend. 235, 1500-2(1952) Dec. 10. (In French)

The specific ionization by cosmic μ mesons and N-component particles was measured by Ne-A-CH_4-filled Geiger-counter telescopes at Chamonix (365 m) for two energy regions: ~0.4 and >1 bev. The results suggest that μ mesons and N particles of equal velocity lose energy at different rates, which is not consistent with any theory proposed to date. An increase in ionization when the momentum of the incident particle exceeded 400 Mev/c was noted, in agreement with theory. (G.Y.)

1491

THE MESONIC AUGER EFFECT. G. R. Burbidge and A. H. de Borde. Phys. Rev. 89, 189-93(1953) Jan. 1.

A simplified nonrelativistic theory of the mesonic Auger effect is presented and discussed. Comparison is made between the predicted and observed numbers of Auger electrons emitted in μ^--meson capture processes. (auth)

1492

A STUDY OF NEUTRAL V PARTICLES. W. B. Fretter, M. M. May, and M. P. Nakada. Phys. Rev. 89, 168-80 (1953) Jan. 1.

The V particles produced in penetrating showers have been studied in a cloud chamber containing Pb plates. The results can be interpreted in terms of two types of neutral unstable particles, $V_1^0 \rightarrow p + \pi$ and $V_2^0 \rightarrow \pi + \pi$, although other possibilities are not excluded by the data. Analysis of the

dynamics of three-particle decay indicates that such a process must still be considered as possible. The lifetimes of the particles have been calculated, taking into account the bias introduced by the finite size of the cloud chamber. If average values are used for the masses of the unstable particles, the lifetime for the V_1^0 is $10 \pm 7 \times 10^{-10}$ sec and for the V_2^0 is $4 \pm 3 \times 10^{-10}$ sec. (auth)

MOLECULAR PROPERTIES

1493

Brookhaven National Lab.

THE STRUCTURE OF PHOSPHINE, by Marshall H. Sirvetz and Ralph E. Weston, Jr. Sept. 2, 1952. 21p. (BNL-1306)

Several low-J microwave transitions of PH_2D and PHD_2 have been observed in the K-band. The effect of centrifugal distortion on the rotational levels has been taken into account approximately, with the result that errors in the computed structure due to this cause now appear to be negligible in comparison with those due to vibration-rotation interaction. One obtains for the P-H distance 1.4177 and 1.4116 A in the two cases; for the H-P-H angle, 93° 21.6′ and 93° 15.4′. The dipole moment has been measured for both species with agreement within experimental error. (auth)

NEUTRONS

1494

Atomic Energy Research Establishment, Harwell, Berks (England)

A METHOD OF MEASURING THE AVERAGE ENERGY OF A NEUTRON SPECTRUM IN THE RANGE 0.3 TO 3.0 M.e.v., by M. E. Mandl. Aug. 1952. 12p. (AERE-T/R-1008)

A method of measuring the average energy of a neutron spectrum for the energy range 0.3 to 3.0 Mev with an accuracy of about 20% is described. The average energy is deduced from the shape of the induced thermal neutron spatial distribution in a sphere of paraffin. Where time and space allow, and where very great accuracy is not necessary, e.g., in animal irradiation experiments with Mev neutrons, this method has considerable advantages from its simplicity. The method has been checked experimentally at energies of 0.6 and 2.9 Mev, where it is in good agreement. (auth)

1495

Oak Ridge National Lab.

A CALCULATION OF THE PROTON-ELECTRON ANGULAR CORRELATION FOR NEUTRON DECAY, by H. L. Reynolds, L. C. Biedenharn, Jr., and D. B. Beard. Issued Jan. 22, 1953. 15p. (ORNL-1444)

The various possible interactions in β-decay theory have been shown by Hamilton (Phys. Rev. 71, 456(1947)) to result in an electron-neutrino angular correlation of the form $1 + (nv/c)\cos\theta_1$, where v is the electron velocity and θ_1 is the angle between the electron and neutrino momenta. The constant n lies between –1 and 1, depending on the type of coupling between the lepton and nuclear fields and for pure interactions has the values 1, $\frac{1}{3}$, $-\frac{1}{3}$, –1 for polar vector, tensor, axial vector, and scalar interactions, respectively. A practical experiment must infer the neutrino direction from observations of the recoil momentum of the residual nucleus. The angular correlations for various interactions are calculated in terms of experimentally observed quantities. Since this is the fundamental β-decay process, the angular correlation can be interpreted directly in terms of the interaction constants, uncomplicated by the problem of the size of the nuclear matrix elements. (L.T.W.)

NUCLEAR PHYSICS

1496

STATISTICAL THEORY OF THE NUCLEUS. I. P. Gombás. Acta Phys. Acad. Sci. Hung. 1, 329-90(1952). (In German)

Chapters in this extensive presentation of the subject include fundamentals of statistical treatment of a free nucleon gas, kinetic energy of a nucleon gas, calculation of nucleon interaction, exchange energy in a nucleon gas, saturation character of exchange forces, statistical model of the nucleus, statistical nucleus with constant nucleon density, calculation of density distribution and energy in the nucleus by the Ritz method, comparison with wave-mechanical calculations on the deuteron, and discussion of the results and their possible extension. (G.Y.)

NUCLEAR PROPERTIES

1497

Argonne National Lab.

NUCLEAR ALIGNMENT AND THE ENTROPY OF LIQUID He^3, by Bernard Weinstock, Bernard M. Abraham, and Darrell W. Osborne. Nov. 1952. 8p. (ANL-4931)

By consideration of the melting pressure data it is shown that calculations implying that the nuclear spins in liquid He^3 are appreciably aligned at temperatures above 0.5°K are inconsistent with the assumption that the nuclear spins are randomly oriented in the solid. The expression $S_{liq} = R \ln 2 + 0.344RT + 0.013RT^3$, for the entropy of liquid He^3 (including the nuclear spin entropy) is consistent with the vapor pressure data from 1.0° to 2.5°K and with the melting-pressure data from 0.5° to 1.5°K. (auth)

1498

Brookhaven National Lab.

DIRECTION AND POLARIZATION CORRELATIONS OF SUCCESSIVE GAMMA-RAYS, by J. J. Kraushaar and M. Goldhaber. [nd] 41p. (BNL-1305)

Experimental arrangements for the measurement of directional and direction-polarization correlations of successive γ rays have been set up and considerations given to instrumental corrections and procedures for the analysis of the data. Directional measurements have been made with Co^{60}, Rh^{106}, Sb^{124}, As^{76}, and Ir^{194}, and direction-polarization measurements with Co^{60}, Rh^{106}, and ThC″. The results are discussed in the light of present information on the systematics of the spins of the excited states of even-even nuclei. The occurrence of mixtures of magnetic-dipole and electric-quadrupole radiation in directional correlation experiments is summarized. (auth)

1499

Brookhaven National Lab.

EXCITED STATES OF EVEN–EVEN NUCLEI, by Gertrude Scharff-Goldhaber. [nd] 7p. (BNL-1321)

The spins and parities of the first excited states of even-even nuclei are tabulated. There are 54 cases of spin 2 and even parity and two cases of spin 0 and even parity. A survey of distribution of known spins and parities of the ground state and first and second excited states of even-even nuclei is shown. From this and the lack of even-even isomers ($\Delta I < 3$), a rule for the nth excited state of an even-even nucleus as a function of neutron number is shown. The energies lie on an approximately smooth curve, decreasing as the neutron number increases, with sharp maxima at magic numbers for neutrons and protons. (L.T.W.)

1500

Brookhaven National Lab.

CLASSIFICATION OF NUCLEAR ISOMERS, by M. Goldhaber. [nd] 7p. (BNL-1322)

The progress made during the last few years permits a definite classification of many nuclear γ-ray transitions according to their multipole character. This classification yields matrix elements for γ transitions which can be compared with calculations based on the one-particle model. For electric transitions, just as for β transitions, deviations from the simple model show up through the "scatter" of the matrix elements. Magnetic transitions, however, have surprisingly uniform matrix elements. In many cases the en-

ergy differences of levels of known spin vary in a regular manner from nucleus to nucleus. For a discussion of these regularities the language of shell theory proves useful. (auth) (cf. AECU-1406; NSA 5-4847)

1501

DETECTION OF MAGNETIC RESONANCE OF EXCITED ATOMIC ENERGY LEVELS. STRUCTURE OF THE $6\,^3P_1$ LEVEL OF THE MERCURY ATOM. Jean Brossel. Ann. phys. (12) 7, 622-54(1952) Sept.-Oct. (In French)

Details of the "double resonance" method for investigating atomic energy levels and results of such investigations on the mean life of the $^3P_1$ state, Landé's coefficient, hyperfine Paschen-Back effect, Bloch-Siegert displacement, and nuclear spins of the separated isotopes Hg^{199} and Hg^{201}, much of which has been published elsewhere (cf. NSA 5-1645, 6-3060, 6-3876), are presented. (G.Y.)

1502

RELATIVISTIC CORRECTIONS TO MAGNETIC MOMENTS OF NUCLEAR PARTICLES. G. Breit and R. M. Thaler. Phys. Rev. 88, 1214-15(1952) Dec. 1.

Further treatment is given to the determination of the proportion of the ^3D state contained in the ground state of the deuteron and to the additivity of magnetic moments of nucleons, with relativistic corrections to the magnetic moments being considered. (L.M.T.)

1503

BARRIER PENETRATION EFFECTS FOR LIGHT NUCLEI. B. E. Freeman and J. L. McHale. Phys. Rev. 89, 223-36 (1953) Jan. 1.

The penetration parameters F_L^2/ρ, ρ/G_L^2, and ρ/A_L^2 have been compared as functions of energy for a number of reactions induced by proton or α-particle bombardment of light nuclei. It was found that these parameters behaved quite similarly in the energy range considered, particularly for $L>0$. The limitations on the applicability of barrier "penetration factors" in the treatment of reaction cross sections are investigated by computing a number of typical cases, making use of the one-body model with allowance for absorption of the incident wave. Several sets of values of nuclear radius and well depth were used. The relation between the one-body cross section without absorption and the channel-penetration parameters, f_L^2/ρ and ρ/g_L^2 is treated in some detail for the $Li^7(p,\alpha)\alpha$ reaction. Breit's consideration of the case of very strong absorption $\sigma_L \approx 1/A_L^2$, is also presented. The connection between the one-body model without absorption and a one-level dispersion formula in the vicinity of sharp resonance is used to tabulate the properties of a number of one-body resonances. In a number of cases resonances were found to be broadened markedly by the absorption of the incident wave in nuclear matter. (auth)

1504

MASSES OF LIGHT ATOMS. K. Ogata and H. Matsuda. Phys. Rev. 89, 27-32(1953) Jan. 1.

The mass differences of 33 doublets have been measured with a modified Bainbridge-Jordan-type mass spectrograph, which has an experimental resolving power of about 60,000. In general, the values obtained are in good agreement with other mass-spectroscopic data and with those calculated from nuclear-disintegration energies. However, for the $C^{12}(H^1)_4-O^{16}$ doublet, the discrepancy between the present value 364.19 ± 0.06 ($\times 10^{-4}$ amu) and the value 363.72 ± 0.19 obtained from nuclear data does not seem to be negligible. The author calculated the atomic mass of C^{12}, one of the mass substandards, from the four different doublet sets, one with the $C^{12}(H^1)_4-O^{16}$ doublet and the others without. The four values of the C^{12} mass obtained were found to be in good agreement with one another, and their weighted average, 12.003844 ± 6, was adopted as the atomic mass of C^{12}. Other mass substandards H^1 and D^2 were calculated from the $(H^1)_2-D^2$ doublet and the $(D^2)_3-\frac{1}{2}C^{12}$ doublet using the above C^{12} mass, and the atomic masses of H^1 and D^2 were obtained to be $H^1 = 1.008145 \pm 2$, $D^2 = 2.014741 \pm 3$. The atomic masses of other isotopes were determined by using these mass substandards. (auth)

1505

ON CLOSED PROTON SHELLS IN NUCLEI OF ATOMIC NUMBER LESS THAN FIFTY. S. Sengupta. Current Sci. (India) 21, 272-3(1952) Oct.

The periodic variation of the number of stable isotopes for even atomic numbers with Z as noted by Elsasser (J. phys. radium 4, 389(1934)) was re-examined up to Z = 50, taking into account new stable isotopes discovered since his work. The increase of the number of stable isotopes with Z is easily seen, however some sharp fluctuations are superposed over this general trend. At Z = 16, 20, and 50 there are peaks and at Z = 8, 28, 34, and 42 there is a sudden increase in the number of stable isotopes. This conforms with previous theoretical and empirical evidence for closed proton shells at 8, 20, 28, and 50. (L.M.T.)

NUCLEAR REACTORS

1506

Atomic Energy Research Establishment, Harwell, Berks (England)

THE MEASUREMENT OF AN ABSOLUTE THERMAL NEUTRON DENSITY IN G.L.E.E.P., by D. J. Littler and E. E. Lockett. Sept. 5, 1952. 15p. (AERE-R/R-961)

By measuring the thermal neutron absorption cross section of Na on the GLEEP oscillator, and by irradiating samples of Na_2CO_3 at the center of GLEEP, and subsequently determining the absolute β activity of these samples, an absolute thermal neutron density at the center of the pile has been measured. This neutron density can be reproduced accurately by measuring the current from a boron-coated ion chamber situated near the center of the pile. The density is at present expressed in terms of the thermal neutron absorption cross section of a particular sample of boron. An absolute measurement of this cross section is being made, but has not yet been completed. The accuracy of the density determination is ±4%, but this error will have to be increased statistically by the error on the determination of the boron cross section. The thermal neutron density which can be provided covers the range of approximately 10 to 2×10^4 n/cm^3. (auth)

1507

Atomic Energy Research Establishment, Harwell, Berks (England)

SOME COMMENTS ON THE CALIBRATIONS OF THE HARWELL NEUTRON SOURCE AND THE G.L.E.E.P. NEUTRON DENSITY, by D. J. Littler and E. E. Lockett. Oct. 7, 1952. 5p. (AERE-R/R-1035; HD-781)

This report summarizes the comparisons which have been made between the Harwell neutron source and other calibrated neutron sources, and between the GLEEP standard neutron density and other neutron density standards. It is shown that all the comparisons agree within the statistical accuracy of the experiments despite the fact that a number of different methods for absolute counting have been employed in establishing the various standards. The comparison measurements have also been regarded as separate determinations of the output of the Harwell neutron source, and the value of the standard neutron density in GLEEP. By combining the comparison measurements with the earlier calibrations, new values are obtained for these two quantities, and the standard errors quoted originally have been considerably reduced. (auth)

1508

Knolls Atomic Power Lab.

A LOW-POWER THERMAL TEST REACTOR ADAPTABLE TO NUCLEAR PHYSICS RESEARCH, by H. B. Stewart, F. G. LaViolette, C. L. McClelland, G. B. Gavin, and T. M. Snyder. Nov. 3, 1952. 23p. (KAPL-832)

A low-power thermal test reactor has been in operation at the Knolls Atomic Power Laboratory for approximately two years. A primary objective in the design of the thermal test reactor was the utilization of the reactor as a sensitive and reliable detector of danger coefficient samples. To achieve this sensitivity the sample is introduced in a graphite thermal column located inside the active lattice. The neutron flux in the sample position is approximately 2.3 times the average flux in the active lattice, and the cadmium ratio of indium activation is 5.9. The critical U^{235} mass of the TTR is 2.7 kg. Experience with the TTR indicates that a reactivity change of 5×10^{-7} in K can be detected by normal danger-coefficient procedures. A cross section of 10^{-3} cm^2 can be measured by routine danger-coefficient methods. (auth)

NUCLEAR TRANSFORMATION

1509

Los Alamos Scientific Lab.

CROSS SECTIONS FOR THE D(d,n)He^3 AND D(d,p)H^3 REACTIONS FROM 14 TO 110 KEV, by W. R. Arnold, J. A. Phillips, G. A. Sawyer, E. J. Stovall, Jr., and J. L. Tuck. Oct. 1952. 21p. (LA-1480)

The absolute differential cross section of the reaction D(d,p)T, and the ratio of the differential cross sections of the reactions D(d,p)T and D(d,n)He^3 and of the reactions D(d,p)T and D(t,n)He^4 were measured at 90° in the lab. system over the range 14 to 110 kev deuteron energy. Cross sections for the D(d,p)H^3 reaction were 13.4 mb at 90 kev and 0.079 mb at 15 kev. Cross sections for the D(d,n)He^3 reaction were 13.1 mb at 90 kev and 0.074 mb at 15 kev. The total D-D cross section gives a straight-line Gamow plot over the lower half of the energy range, corresponding to a total cross section of $(2.88 \times 10^2/E)\exp(-45.8E^{-\frac{1}{2}})$. (L.T.W.)

1510

ANGULAR DISTRIBUTION OF GAMMA-RAYS AND SHORT-RANGE ALPHA-PARTICLES FROM $N^{15}(p,\alpha\gamma)C^{12}$. Alfred A. Kraus, Jr., A. P. French, William A. Fowler, and C. C. Lauritsen. Phys. Rev. 89, 299-301(1953) Jan. 1.

Measurements of the angular distributions of γ rays and α particles from the reaction $N^{15}(p,\alpha\gamma)C^{12}$ indicate that the 4.432-Mev excited state of C^{12} is 2^+ or >4, that the 12.51-Mev level of O^{16} is 2^- or >5, that the 12.95-Mev level is 2^- or >5, and that the 13.24-Mev level is 4^+ or >5. (auth)

1511

ELECTRON EJECTION FROM Mo BY He^+, He^{++}, and He_2^+. Homer D. Hagstrum. Phys. Rev. 89, 244-55(1953) Jan. 1.

Total yield and kinetic-energy distribution have been measured for electrons ejected from atomically clean and gas-covered Mo by the ions He^+, He^{++}, and He_2^+ in the kinetic-energy range 10 to 1000 ev. Evidence is presented that one electron is excited into the kinetic-energy continuum for each incident He^+ ion and that the electrons so excited are partially internally reflected at the potential barrier of the metal. The slowest ions observed were found to eject 0.25, 0.72, and 0.13 electron per ion for He^+, He^{++}, and He_2^+, respectively. Total electron yield is found to be nearly independent of ion kinetic energy up to 1000 ev. This observation and that of the kinetic energy-maximum for slow ions indicate that the electrons are released in an Auger-type process for which the energy is supplied by the potential and not the kinetic energy of the ion (potential ejection). Electrons of kinetic energy greater than the upper limit predicted by present theory are observed for faster ions and are accounted for by the shift of the energy levels of the bombarding particle when it is near the metal surface. Some conclusions concerning reflection processes at a metal surface and the nature of electron ejection by the α particle (He^{++}) and the molecular helium ion (He_2^+) come out of this work. (auth)

1512

ALPHA-RADIOACTIVITY IN THE 82-NEUTRON REGION. J. O. Rasmussen, Jr., S. G. Thompson, and A. Ghiorso. Phys. Rev. 89, 33-48(1953) Jan. 1.

In a survey for α activity among cyclotron-produced neutron-deficient nuclides of the elements below Pb, α activity was detected in a number of rare-earth nuclides with atomic number greater than 62, that of Sm, and in a Au and a Hg nuclide. A detailed study of the α-active nuclides of Eu, Gd, Tb, and Dy was made. The relationship between α-decay rates and energies in the rare-earth region is examined. Calculations of the "effective nuclear radius for alpha particles" were made using five different α-decay-rate formulas. The trends of the rare-earth α-decay energies are discussed, particularly with respect to the discontinuity in neutron binding energies at the closed shell of 82 neutrons. 56 references. (auth)

1513

FORMATION OF He^6 BY 14-MEV NEUTRON BOMBARDMENT OF Li AND Be. M. E. Battat and F. L. Ribe. Phys. Rev. 89, 80-3(1953) Jan. 1.

Formation of He^6 by bombardment of Li^6, Li^7 and Be^9 with 14-Mev neutrons has been observed. The He^6 was identified by its known half life, and the decay rate was observed on a ten-channel time-delay analyzer. Beta rays from the He^6 were detected by means of a thin-walled proportional counter, and the over-all counting efficiency was determined by using the $Cu^{63}(n,2n)Cu^{62}$ reaction. Cross sections determined for the $Li^6(n,p)$, $Li^7(n,d)$, and $Be^9(n,\alpha)$ reactions were 6.7 ± 0.8, 9.8 ± 1.1, and 10 ± 1 millibarns, respectively. The half life of He^6 was found to be 0.83 ± 0.03 sec. (auth)

PARTICLE ACCELERATORS

1514

Purdue Univ.

LINEAR ELECTRON ACCELERATOR: TECHNICAL REPORT NO. I [ON] TRANSVERSE MOTION OF AN ELECTRON IN A CONSTANT WAVE SPEED SECTION OF A LINEAR ACCELERATOR, by Ira Jacobs and E. S. Akeley. June 1952. 44p. (AECU-2338; Technical Report No. I)

The relativistic differential equations of motion of an electron in a linear accelerator are considered. The field components are expanded in powers of distance from the axis $\underline{r}$, and terms in $\underline{r}$ and $\dot{\underline{r}}$ of order two higher than the lowest-order terms are neglected. The equations for the θ (azimuthal angle) and $\underline{z}$ (longitudinal distance) coordinates are integrated once, and the first integrals are used to eliminate θ and $\underline{z}$ from the equation for the $\underline{r}$ coordinate. By taking a special d-c magnetic focusing field, it is possible to integrate twice this second-order nonlinear differential equation, obtaining $\underline{r}$ as a function of phase. From Caplan's data of phase against $\underline{z}$, $\underline{r}$ is then plotted against $\underline{z}$ for various sets of initial conditions. The particular field chosen has the advantage that with it, the electron will oscillate between known fixed limits of $\underline{r}$. The length of section for which the focusing field should be used is indicated, and the necessity of shielding the electron emitter from this field is shown. (auth)

1515

Purdue Univ.

PROGRESS REPORT [ON] LINEAR ELECTRON ACCELERATOR. June 15, 1951. 40p. (AECU-2340)

The design and theory of the 7.1-Mev linear electron accelerator are discussed, with special emphasis on the waveguide. A method for measuring the drift velocity of electrons in gases and a proposed study of metastable nuclear states are also reported. (L.M.T.)

1516

Purdue Univ.

PROGRESS REPORT [ON] LINEAR ELECTRON ACCELERATOR. June 30, 1952. 8p. (AECU-2341)

This report covers the construction of components and testing of the linear electron accelerator during the period June 15, 1951, to June 30, 1952. The status of research, using the accelerator in its temporary location, is also reported. (auth)

1517

Atomic Energy Research Establishment, Harwell, Berks (England)

PHASE DEBUNCHING BY FOCUSSING-FOILS IN A PROTON LINEAR ACCELERATOR, by J. S. Bell. Sept. 1952. 12p. (AERE-T/M-68)

The statistical variation of energy loss of particles traversing focusing foils in a Berkeley-type accelerator leads to phase debunching. A treatment of the effect is developed which is based on an analysis by Landau of straggling in single foils. The method is valid for small bunches. Calculations are done for a 47- to 470-Mev machine with operating wavelength 1.5 m, energy gradient 2.3 Mev/m, and synchronous phase 20°. With 3×10^{-4}-in. Be foils the final bunch width is quite tolerable, being of the order of a few degrees. The foils may be somewhat thicker without affecting the over-all bunch width, but it varies inversely with the square root of the wavelength. (auth)

1518

Brookhaven National Lab.

THE UNIQUE BROOKHAVEN NATIONAL LABORATORY COSMOTRON MOTOR GENERATOR FOUNDATION, by John M. Ruddy. [nd] 7p. (BNL-1302)

This unique dynamic foundation problem was occasioned by the unusual operation of the large motor-generator set comprising a large special 12-phase a-c generator complete with ignitron rectifiers and connected through a 45-ton flywheel to a 1750-hp induction motor. The motor-generator foundation must resist a 2-ton rocking motion 5,000 times per 8-hr day and one or two short circuits per day causing large tension and compression forces on the foundation. The four distinct loading conditions considered for proper design were (1) static foundation loading, 330,000 lb, (2) starting and idling reactions, (3) normal operation loading (rocking motion), and (4) faults and short-circuit reaction loadings, 176,000 lb compression on one side and 127,000 lb tension on the other side of the generator foot support area. The final type of structure and size are given, after consideration of these basic criteria and additional secondary design criteria. (L.M.T.)

1519

Radiation Lab., Univ. of Calif., Berkeley

AN ANALYSIS OF THE PULSED ELECTROSTATIC DEFLECTOR IN THE 184-INCH SYNCHROCYCLOTRON, by Warren Fenton Stubbins. Dec. 1, 1952. 14p. (UCRL-2037)

The trajectories of protons deflected by the pulsed electrostatic deflector in the present 184-in. synchrocyclotron (maximum proton energy of 340 Mev) are studied by using a differential analyzer. Particles successfully ejected from the cyclotron field into the magnetic channel have large radial oscillations and enter the deflecting system at a phase that keeps them in its electric field over the deflector's length of 120°. This type of deflector is not deemed suitable for use in the 184-in. synchrocyclotron when it is modified to a higher maximum proton energy. (auth)

RADIATION ABSORPTION AND SCATTERING

1520

Naval School of Aviation Medicine, Pensacola

MEASUREMENT OF BETA RAY BACKSCATTERING BY RADIOAUTOGRAPHY OF MONOLAYERS, by Dietrich E. Beischer. Nov. 20, 1951. 14p. (NM-001-059.16.06)

The backscattering coefficients of different materials were measured under the particular experimental conditions being used in radioautography. A "weightless" homogeneous monolayer of C^{14}-tagged stearic acid was applied as an ideal radiation source between the photographic emulsion and the backscattering material. The values obtained compare favorably with corrected data determined by using the G-M counter. They should prove to be of great help in comparisons of radioautographs of specimens on different supporting materials. (auth)

1521

SYMMETRY REQUIREMENTS IN ELECTRON SCATTERING BY AN ATOM. L. E. H. Trainor and Ta-You Wu. Phys. Rev. 89, 273-4(1953) Jan. 1.

It is pointed out that in the treatment of the problem of electron scattering by an atom, including the effect of the Pauli principle, the use of unsymmetrized wave function and asymptotic conditions in one electron does not ensure the required asymptotic conditions in the other electron. However, the use of symmetrized wave functions automatically ensures symmetrical asymptotic conditions in both electrons. (auth)

1522

BREMSSTRAHLUNG CROSS SECTION OF 60-MEV ELECTRONS IN LEAD. C. D. Curtis. Phys. Rev. 89, 123-30(1953) Jan. 1.

Sixty-Mev electrons from a pulsed betatron passed through Pb foils of thicknesses 0.001, 0.005, and 0.015 in. placed in a magnetic cloud chamber. Measurements of approximately 1100 large-energy losses gave the differential bremsstrahlung cross section as a function of x-ray energy for the high-energy portion of the x-ray spectrum. Corrections were applied for instrumental discrimination and for multiple-radiation and ionization-energy losses in the foils. While the shape of the top 30% of the x-ray spectrum agreed with the theory within experimental uncertainty, the magnitude of the cross section was about 7% lower than theory. (auth)

RADIATION EFFECTS

1523

Atomic Energy Research Establishment, Harwell, Berks (England)

THE EFFECT OF PILE RADIATION ON THE DENSITY AND MELTING OF POLYTHENE, by A. Charlesby and M. Ross. Aug. 21, 1952. 21p. (AERE-M/R-1003)

The density of polythene has been studied in relation to temperature and the degree of crosslinking produced by pile irradiation. Crosslinking results in a progressive reduction in the percentage of crystalline material at room temperature. The transition temperature corresponding to melting in ordinary polythene is only very slightly decreased with increasing crosslinking, so that the temperature at which all crystalline structure vanishes is little affected. However, because of the reduced amount of crystalline material present in the crosslinked polymer, the magnitude of the change in density at the transition temperature is considerably lessened. There are certain anomalies between the transition temperature deduced from density measurements and from other methods. The density

of crosslinked polythene in the amorphous state is found to obey a law very similar to the Van der Waals law for gases:

$$\left(P + \frac{P_0}{1-\beta c}\right)(V(c) - V_0) = RT/M$$

where P_0 is the internal pressure arising from binding forces, V_0 is a constant corresponding to a "residual" volume per gram at 0°K independent of the degree of crosslinking c, and β is a constant close to unity. P represents the external pressure, V(c) is the specific volume (or volume per gram) of crosslinked polymer, and M is the molar weight 28 (CH_2-CH_2). (auth)

1524

Purdue Univ.

FIRST QUARTERLY REPORT [ON] RADIATION DAMAGE RESEARCH [FOR] JULY 1 TO SEPTEMBER 30, 1952. [nd] 27p. (COO-102)

Progress is reported on the hardness of Mo before and after irradiation, the influence of neutrons on the low-temperature atomic heat of Si, an x-ray- and electron-diffraction study of radiation damage in single crystals of Ge and Si, thermal conductivity of Ge, electric measurements on Mo, and electron bombardment of Ge. (L.T.W.)

1525

North American Aviation, Inc.

THE USE OF CYCLOTRON IRRADIATION IN THE STUDY OF RADIATION EFFECTS ON MATERIALS, by H. P. Yockey, F. L. Fillmore, C. D'A. Hunt, A. Andrew, L. Glasgow, F. R. Weber, Jr., M. R. Jeppson, J. H. Pepper, and R. E. Carter. Issued Dec. 16, 1952. 124p. (NAA-SR-186)

This report describes the methods and equipment developed by the Atomic Energy Research Department of North American Aviation, Inc., for the irradiation of materials under controlled conditions on the 60-inch Berkeley cyclotron. A description is given of various pieces of apparatus for use in the temperature range of –195 to 2000°C. These include the target boxes which accurately locate the specimens to be irradiated in the cyclotron beam, a cold helium circulating system which is used to cool targets to about –195°C, and a servo temperature controller which automatically regulates the temperature of targets which are to be irradiated at elevated temperatures. Various typical targets are described along with the conditions of irradiation. The method of determining the spacial distribution of the irradiation intensity is given and the associated errors are discussed. (auth)

RADIOACTIVITY

1526

Brookhaven National Lab.

INFLUENCE OF THE CHEMICAL STATE ON THE LIFE-TIME OF A NUCLEAR ISOMER, Tc^{99m}, by Kenneth T. Bainbridge, M. Goldhaber, and Elizabeth Wilson. [nd] 35p. (BNL-1327)

A nuclear isomeric transition takes place by emission of γ rays and internal-conversion electrons, and the decay rate may be expected to depend on the electronic environment. Differences in the decay constant of the isomer Tc^{99m} (6-hr) in different states of chemical combination were measured by the double-ionization-chamber balance method. λ for this isomer is determined preponderantly by the internal-conversion probability of a 2-kev transition which is followed promptly by a 140-kev γ ray convenient for measurement. Two compounds in the +7 valence state were compared. $\lambda(KTcO_4) - \lambda(Tc_2S_7) = 27.0 \pm 1.0 \times 10^{-4}\ \lambda(Tc_2S_7)$. λ for the metal electroplated on Ni and reduced in H_2 at 1000°C for 1 hr $-\lambda(Tc_2S_7) = 3.1 \pm 1.2 \times 10^{-4}\ \lambda(Tc_2S_7)$. Errors are standard deviations. There is evidence for diffusion into the Ni base of the Tc and an accompanying decrease in λ(Tc) of ~2 parts in 10^4 compared to pure crystalline metal. λ of the metal was measured directly as $0.1148 \pm 0.0005\ h^{-1}$, corresponding to a period of half life of 6.04 ± 0.03 hr (limit of error). Two methods for internally checking the data and operation of the apparatus are illustrated, and the statistics of the measurements are discussed. (auth)

1527

Institute for Atomic Research, Iowa State Coll.

RADIATIONS FROM SELENIUM 75, by Erling N. Jensen, L. Jackson Laslett, Don S. Martin, Jr., Francis J. Hughes, and William W. Pratt. [nd] 22p. (ISC-252)

The radiations from 125-day Se^{75} have been examined by means of a thin-lens spectrometer and absorption-coincidence techniques. Se^{75} was found to decay to As^{75} by orbital electron capture. The energies of ten transitions (0.066_6, 0.076_4, 0.098_3, 0.124_1, 0.138_4, 0.203_2, 0.268_8, 0.281_4, 0.307_8, and 0.405_0 Mev) were observed in the photoelectron and internal-conversion spectra determined with the spectrometer. A decay scheme is proposed on the basis of the absorption-coincidence and spectrometer data. The multiple order of the 98.3-kev transition is discussed. (auth)

1528

RESEARCH ON SHORT-LIFE β RADIOACTIVITY AND NUCLEAR ISOMERISM. Georges Vendryès. Ann. phys. (12) 7, 655-709(1952) Sept.-Oct. (In French)

Details of experiments on the β disintegrations of Li^8 and B^{12} (cf. NSA 5-6497, 5-6504) and development of apparatus for measuring half lives between 0.01 and 1 sec (cf. NSA 5-6844) are presented. 30 figures. (G.Y.)

1529

THE RADIOACTIVITY OF THE HOT SPRINGS AT TIBERIAS. D. B. Rosenblatt and H. Lindeman. Science 116, 689-90 (1952) Dec. 19.

Studies with an α-detecting flow-type methane proportional counter proved that the radioactivity of the Tiberias, Israel, hot springs is that of Rn dissolved in the water. The highest activity found was 2.18×10^{-11} c/ml. Attempts to detect and indentify traces of long-life activities in aged salts obtained by evaporation of the water were inconclusive. (G.Y.)

1530

CHARACTERISTICS OF Br^{87}, A DELAYED NEUTRON ACTIVITY. Andrew F. Stehney and Nathan Sugarman. Phys. Rev. 89, 194-203(1953) Jan. 1.

The energies of the β rays of Br^{87} were determined to be 2.6 and 8.0 Mev by Al-absorption measurements. γ radiation was observed, and from the absorption curve of the secondary Compton electrons, the maximum energy of the γ radiation was found to be 5.4 Mev. Most of the γ rays have energies in the range 2 to 4 Mev. Coincidences were observed between the weaker β ray and the γ rays. γ-γ coincidences were also noted. The fission yield of Br^{87} was found to be 3.1%. (auth)

1531

THE BETA-DECAY OF THE TRITON. John M. Blatt. Phys. Rev. 89, 86-92(1953) Jan. 1.

A general formula is derived for the β-decay matrix elements in the decay of a nucleus into its mirror nucleus. This formula is specialized to the decay of H^3. Under the assumption of charge independence of nuclear forces, it is shown that the value $(\int\vec{\sigma})^2 = 3$ computed on the basis of a pure $^2S_{1/2}$ ground state is an upper limit for the true value of this matrix element, provided only that the $^2S_{1/2}$ state is present with a probability of at least 25%. (auth)

1532

THE BETA-DECAY INTERACTION. John M. Blatt. Phys. Rev. 89, 83-5(1953) Jan. 1.

The recent identifications of two β decays as 0-to-0

transitions proves that the β-decay interaction must contain a component obeying Fermi selection rules. Evidence is presented regarding the relative strengths of the Fermi and Gamow-Teller interactions, and experiments are suggested to improve our knowledge of these strengths. It is pointed out that the He^6 ft value does not give significant information about the β-decay interaction. An experiment is proposed to determine the nature (scalar or polar vector) of the Fermi interaction. 18 references. (auth)

1533

ALPHA INSTABILITY OF RARE EARTH NUCLIDES. S. Jha and G. P. Dube. J. phys. radium 13, 634-6(1952) Dec. (In French)

Nuclear shell structure, in admitting diminishing bond energies for the first nucleons following completed subshells, is shown to explain the α radioactivity of Sm^{147} and Pm^{145} and to permit prediction of that of neighboring nuclides. (auth)

1534

DOUBLE β RADIOACTIVITY; SYSTEMATIC RESEARCH ON FAVORABLE CASES. Jean-François Detoeuf, Raymond Moch, and Jean Salmon. J. Phys. radium 13, 618-33(1952) Dec. (In French)

A systematic study of nuclides susceptible to double β decay has been carried out. The first investigation used the semiempirical equations relating, in the liquid-drop theory, the atomic masses of isobaric nuclei to their atomic number. In the second study the authors evaluated directly the energy available for the transition $Z \rightarrow Z + 2$ from experimental data on the β spectra of $Z + 1$ nuclei. Comparison of the results of these two investigations showed that there exists a privileged region for double β radioactivity in the middle of the periodic table ($80 < A < 130$). About 15 possible nuclides are suggested for which available energy and half life are calculated. The most favorable are the isotopes of Sn, Pd, Cd, Mo, and Ru. (tr-auth)

1535

ABNORMAL RADIOACTIVITY IN THE ATMOSPHERE. Hubert Garrigue. Compt. rend. 235, 1498-9(1952) Dec. 10. (In French)

Results of systematic studies of atmospheric radioactivity in the vicinity of the Puy de Dôme observatory from Apr. 11 to July 1, 1952 are tabulated. During a low-altitude flight (1400 m) on Apr. 25 the presence of abundant nonlocal soot and radioactive substance A was revealed. In June, sufficient activity of the type A″ was collected at 4000 m to permit accurate decay measurements. Two components, one with 100 to 150-hr, the other with ~400-hr half life, were found. (G.Y.)

1536

BRITISH STANDARD OF RADIOACTIVE IODINE (^{131}I). E. C. Bullard. Nature, 170, 916-17(1952) Nov. 29.

As a result of improved standardizing techniques and more precise information concerning the I^{131} decay scheme, it was decided to revise the 1948 I^{131} standard. Samples were sent to the three laboratories primarily concerned with standardization, and the value as determined by the ionization method and by counter methods was 2.25 r/hr at 1 cm from a 1 mc source. This standard, which was adopted, is smaller than the previous standard by a factor of 1:1.13. (L.M.T.)

1537

INVESTIGATION OF L SPECTRA EXCITED BY INTERNAL CONVERSION. Michel Riou. J. phys. radium 13, 593-600 (1952) Dec. (In French)

The probabilities of excitation of the three L sublevels are compared for the following modes of excitation: electron bombardment, external photoelectric effect, and internal conversion of γ radiation. Experimental results are reviewed and relative intensities of L spectrum lines excited by internal conversion are calculated for the case of heavy atoms. The L-shell fluorescence yield is determined. (tr-auth)

SHIELDING

1538

Wisconsin Univ.

HOUSING FOR Co^{60} GAMMA RAY SOURCE FOR EXPERIMENTAL WORK, by R. F. Firestone and J. E. Willard. [nd] 9p. (AECU-2351)

This note describes a relatively simple and convenient type of housing for multicurie radioactive sources which are to be used for irradiation of various types of samples at varied temperatures. (auth)

1539

Technical Information Service, AEC

RADIATION SHIELDS AND SHIELDING; A BIBLIOGRAPHY OF UNCLASSIFIED AEC REPORT LITERATURE. Charles J. Engberg, comp. Sept. 1952. 26p. (TID-3032)

This compilation of 130 annotated references to the unclassified report literature on radiation shields and shielding covers reports held by the Technical Information Service as of September 19, 1952. The bibliography covers reports on shields necessary for personnel and equipment protection in laboratories which contain either a reactor, a particle accelerator, or radioisotopes. Reports which deal with the shields necessary to study the biological effects of whole-body irradiation are also included. The shielding theories are covered for all radiations with major emphasis given to neutron and gamma rays since these two radiations cause the greatest shielding problems. (auth)

THEORETICAL PHYSICS

1540

MESON THEORY OF β-DECAY AND THE ΔL-FORBIDDEN TRANSITIONS. Seitaro Nakamura. Phys. Rev. 89, 16-19 (1953) Jan. 1.

Existence of the β meson of vector type which is neither a π nor μ meson and which transmits the β decay of nuclei has been tentatively assumed, the results thus derived being compared with experiments on β decay. The differences between the β-meson theory and the phenomenological Fermi theory lie in the natural deduction of the vector interaction as well as the introduction of new nuclear matrix elements which are characteristic of the meson dipole. The selection rules for the ΔL-forbidden transitions are involved in these matrix elements, the orders of which are expected to be that of the unfavored parity transitions in each degree of forbidden transitions. The observability of a free β meson is also discussed. 33 references. (auth)

1541

CLASSICAL AND QUANTUM FIELD THEORIES IN THE LAGRANGIAN FORMALISM. Peter G. Bergmann and Ralph Schiller. Phys. Rev. 89, 4-16(1953) Jan. 1.

Actual methods of computation are presented for determining the relationship between the transformation properties of a nonquantum covariant field theory and its constraints, generating functionals, conservation laws, and "superpotentials" within the Lagrangian formalism. The probable structure of a quantum covariant field theory is discussed, both in the Hamiltonian and in the Lagrangian formalism. In the Hamiltonian formalism, it is suggested that those field variables canonically conjugate to constraints are not observables in the physical sense nor operators in Hilbert space, and that the states of a system which alone can be regarded as Hilbert vectors are those consistent with all the constraints inherent in the theory and its transformation properties. In the Langrangian quantization development, a new set of field equations are proposed which are different from the usual ones but which can be shown to permit the transition to the canonical formulation if desired. 14 references. (auth)

1542

THE LAMB SHIFT FOR HYDROGEN AND DEUTERIUM.

E. E. Salpeter. Phys. Rev. 89, 92-7(1953) Jan. 1.

Previous calculations of all second- and fourth-order radiative corrections, which contribute to the Lamb shift, are discussed. Further corrections to the Lamb shift in H and D, resulting from the finite mass and internal structure of the nuclei, are calculated. The final theoretical results for the Lamb shift, excluding all sixth-order corrections, are 1057.19 ± 0.16 Mc for H and 1058.49 ± 0.16 Mc for D. These values are about half a Mc smaller than the corresponding experimental results. (auth)

1543

THE SIMILARITY THEORY OF RELATIVITY AND THE DIRAC-SCHRÖDINGER THEORY OF ELECTRONS. Banesh Hoffmann. Phys. Rev. 89, 52-9(1953) Jan. 1.

The similarity theory of relativity is shown to contain the recent Dirac-Schroedinger theory of electrons as a special case. The variational principle is built on the curvature scalar formed from the basic symmetric similarity tensor $S_{\sigma\tau}$, and leads to a unified field theory of the gravitational field, the electromagnetic field, a scalar field of the sort used by Jordan in his theory of the variable gravitational constant, a charged scalar particle field, and a vector particle field. (auth)

1544

THE CANONICAL TRANSFORMATION FOR AN ELECTRON-POSITRON FIELD COUPLED TO A TIME-INDEPENDENT ELECTROMAGNETIC FIELD. H. E. Moses. Phys. Rev. 89, 115-22(1953) Jan. 1.

The problem of the electron-positron field coupled to an unquantized electromagnetic field, constant in time, is solved in the Schroedinger picture by finding a suitable canonical transformation. It is shown that in the number representation this transformation satisfies an integro-difference equation which can be solved by means of a perturbation scheme in a manner analogous to the finding of one-particle canonical transformations. It is shown, moreover, that this canonical transformation can be expressed in terms of single-particle canonical transformations. (auth)

1545

ON A CONVERGENT MESON THEORY. I. P. Kristensen and C. Møller. Kgl. Danske Videnskab. Selskab Mat. fys. Medd. 27, No. 7(1952) 51p. (In English)

The introduction of a form factor in the interaction between particles of spin 1/2 (nucleons) and pseudoscalar mesons is shown to lead to a consistent S-matrix theory with correspondence to the usual field theory. The S-matrix is derived to the second order in the coupling constants, and the expressions for the self-energies of mesons and nucleons are derived from the one-particle part of the S-matrix. It is shown that the form factor can be chosen in such a way that the self-energies are finite and small. Some of the most striking differences between the present formalism and ordinary quantum mechanics are discussed. It is shown that the theory can be made gage invariant in the sense that a gage transformation is equivalent to a quasi-canonical transformation, which means that a gage transformation has no effect on the physical predictions derived from the theory. The introduction of the form factor also makes the vacuum polarization finite to the approximation considered. (G.Y.)

URANIUM AND URANIUM COMPOUNDS

1546

Atomic Energy Research Establishment, Harwell, Berks (England)

A HIGH TEMPERATURE ADIABATIC CALORIMETER; THE SPECIFIC HEAT OF URANIUM BETWEEN 100° AND 800°C, by J. M. North. Sept. 23, 1952. 19p. (AERE-M/R-1016)

The apparatus described enables the measurement of the specific heat of solid materials to be made in vacuum in the temperature range of 100 to 800°C. The specimen is heated electrically, and is supported in an enclosure which is kept at the same temperature by a servomechanism. Under these conditions the specimen neither loses nor gains heat from its surroundings, and by measurement of the energy input to the specimen and its rate of temperature increase the specific heat may be calculated. The reproducibility of the method is ±2%. The specific heat of U has been measured between 100 and 800°C, and the latent heats of transformation of the α-β and β-γ change points have been determined. Modifications for improving the accuracy of the method are suggested. (auth)

1547

Atomic Energy Research Establishment, Harwell, Berks (England)

THE SYSTEM URANIUM-LEAD, by J. T. Maskrey and B. R. T. Frost. Oct. 14, 1952. 27p. (AERE-M/R-1027)

The system U-Pb has been investigated by means of micrographic, x-ray, and thermal-analysis methods. A number of new experimental methods have been developed to overcome difficulties due to the pyrophoric nature of the alloys and to segregation. The properties and behavior of seven compounds of the general formula UX_3, where X is an element of Group IIIB or IVB in the periodic table, have been discussed in relation to their crystal structures. (auth)

PATENTS

CHEMISTRY

1548

METHOD FOR PREPARING BORON TRIFLUORIDE. I. Kirshenbaum (to U. S. Atomic Energy Commission). U. S. Patent 2,622,014, Dec. 16, 1952.

This method for preparing BF_3 comprises heating a dry mixture of an oxide of boron and a higher metal fluoride such as CoF_3 or SbF_5 at a temperature of from 115 to 190°C and at atmospheric pressure and collecting the evolved BF_3 gas.

1549

PRODUCTION OF CARBON DIOXIDE. W. W. Miller, J. Turkevich, and N. Zwiebel (to U. S. Atomic Energy Commission). U. S. Patent 2,622,008, Dec. 16, 1952.

This method of liberating radioactive CO_2 from an alkaline earth carbonate comprises preparing an intimate mixture of the dry carbonate salt and a dry metal halide such as Pb chloride, Cd iodide, or Cu bromide, and heating mixture to a temperature in the range 400 to 500°C at a pressure of less than 10^{-2} mm Hg.

1550

REMOTE CONTROL PIPETTING UNIT. H. C. Andrews and J. F. Gifford (to U. S. Atomic Energy Commission). U. S. Patent 2,624,656, Jan. 6, 1953.

This pipette assembly has remotely controlled means to control horizontal and vertical movement to control the release of fluid, and to flush the interior as well as wash the exterior when desired.

1551

METHOD OF ELECTRODEPOSITING NICKEL. S. A. Mayper (to U. S. Atomic Energy Commission). U. S. Patent 2,625,507, Jan. 13, 1953.

This method for producing Ni powder having a mean particle size of between 7 and 15 μ comprises electrodepositing Ni on an inert cathode such as stainless steel, at a cathode current density of from 0.05 to 0.30 amp/cm² for a fixed

interval of time such as 15 min to 3 hr, from an aqueous solution containing soluble chlorides of Ni, Na, and ammonium in respective concentrations of about 0.1M, 1M, and 1M, and employing a Ni metal anode and another anode of inert material, such as carbon, and adjusting the current carried by the different anodes so as to maintain a substantially constant Ni ion concentration in the bath.

1552
METHOD OF POLYMERIZING TRIFLUOROCHLOROETHYLENE. W. T. Miller and J. T. Maynard (to U. S. Atomic Energy Commission). U. S. Patent 2,626,254, Jan. 20, 1953.

This method of preparing polytrifluoromonochloroethylene comprises contacting a completely halogenated acetyl halide or acetic anhydride, such as trichloroacetyl chloride or bistrifluoroacetic anhydride, dissolved in trifluoromonochloroethylene with an inorganic metal peroxide, such as sodium peroxide, to produce the peroxide of the acetyl compound in situ, and maintaining the reaction mass at such a temperature as to decompose the acetyl peroxide thereby causing the polymerization of the trifluoromonochloroethylene.

1553
METHOD OF MAKING ZIRCONIUM TETRACHLORIDE. W. B. Blumenthal (to U. S. Atomic Energy Commission). U. S. Patent 2,626,203, Jan. 20, 1953.

This patent covers a method for preparing $ZrCl_4$ from ZrF_4 comprising reacting the latter compound with $MgCl_2$, either alone or in a bath of molten $SnCl_2$, at a temperature from 350 to 900°C and recovering the $ZrCl_4$ distilled from the reaction mass.

MINERALOGY, METALLURGY, AND CERAMICS

1554
RECEPTACLE. R. N. Lyon, S. G. Bankoff, and F. J. Smetana (to U. S. Atomic Energy Commission). U. S. Patent 2,621,912, Dec. 16, 1952.

This quenching container or basket has baffle means for positively effecting random distribution of elongated members dumped therein for quenching purposes.

PHYSICS

1555
MONITORING GAS FOR RADIOACTIVE XENON. W. R. Kanne (to U. S. Atomic Energy Commission). U. S. Patent 2,625,657, Jan. 13, 1953.

This ionization chamber for monitoring the radioactivity of a gas stream is arranged so that any ions carried along by the incoming gas will be grounded out prior to the gas entering the ionization chamber.

1556
TARGET FOR PARTICLE ACCELERATORS. F. R. Weber, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,626,359, Jan. 20, 1953.

Means are provided for mounting a plurality of samples to be irradiated and oscillating a sample in the beam so as to obtain uniform bombardment of the target area. The targets are changed by remote control without interrupting the operation of the particle accelerator.

1557
BEAM EXTRACTOR. W. M. Powell (to U. S. Atomic Energy Commission). U. S. Patent 2,626,351, Jan. 20, 1953.

In this method and apparatus for the removal of a beam of charged particles from a particle accelerator such as a frequency-modulated cyclotron, the extraction is accomplished by applying a high-voltage pulse to electrostatic deflecting electrodes when ions of a desired energy level are within the influence of the electrodes, thus deflecting the ions from their circular path and directing them through a magnetically shielded region to the particle exit of the accelerator.

1558
COINCIDENCE CIRCUIT. L. F. Wouters (to Atomic Energy Commission). U. S. Patent 2,625,653, Jan. 13, 1953.

This photomultiplier tube coincidence circuit is capable of detecting a coincidence between a pulse of light and a pulse of electrical energy. The apparatus is particularly useful for determining the phase relation between the accelerating r-f voltage and the particles of a particle accelerator.

1559
ARC HASH ANALYZER BY CATHODE-RAY TUBE. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,624,860, Jan. 6, 1953.

This analyzer, comprising a cathode-ray tube and associated components, displays the wave form existing during a selected time interval of any section of an electrical signal.

1560
BALLISTIC ELECTROMETER. W. P. Jesse, J. W. Broxon, and W. H. Hinch (to U. S. Atomic Energy Commission). U. S. Patent 2,624,847, Jan. 6, 1953.

A method and apparatus, employing a ballistic electrometer, for measuring and recording the very small ionization currents produced by low-intensity radiation are described.

1561
ION SOURCE. R. W. Thompson (to U. S. Atomic Energy Commission). U. S. Patent 2,624,845, Jan. 6, 1953.

This ion-source unit for a mass spectrometer utilizes a sealed receptacle containing a relatively pure, anhydrous charge material that is to be vaporized and ionized. The receptacle may be opened after the ion-source unit has been placed in the vacuum chamber.

1562
METHOD OF AND APPARATUS FOR ACCELERATING TO HIGH ENERGY ELECTRICALLY CHARGED PARTICLES. E. M. McMillan (to U. S. Atomic Energy Commission). U. S. Patent 2,624,841, Jan. 6, 1953.

This patent describes the synchrotron.

1563
APPARATUS AND METHOD FOR MEASURING MAGNETIC FLUX. V. A. Nedzel (to U. S. Atomic Energy Commission). U. S. Patent 2,624,783, Jan. 6, 1953.

The strength of an unknown magnetic field is found by developing a magnetic field of known strength, developing electromotive forces proportional to the unknown and known fields, combining the electromotive forces in opposition one to the other, and measuring their difference.

1564
ION SOURCE. R. R. Wilson (to U. S. Atomic Energy Commission). U. S. Patent 2,624,009, Dec. 30, 1952.

This multiple ion source is capable of continuously producing a copious supply of gaseous ions on a large scale. The plurality of ion sources arranged in juxtaposition in a single evacuated space is provided with a feeding means to automatically supply material to be ionized to each of the ion sources in succession.

1565
RADIOACTIVE PARTICLE COUNTING. W. Bernstein and R. Ballentine (to U. S. Atomic Energy Commission). U. S. Patent 2,622,208, Dec. 16, 1952.

This readily dismantled radioactive-particle counting device includes means for collecting the substance whose radioactivity is to be measured. Two electrodes insulatedly mounted on a base plate are surrounded by a detachably mounted envelope arranged to be evacuated and subsequently continuously supplied with a suitable counting gas.

1566
MASS SPECTROGRAPH. A. E. Shaw and W. Rall (to U. S. Atomic Energy Commission). U. S. Patent 2,622,204, Dec. 16, 1952.

This double-focusing mass spectrograph is provided with a unitary subassembly for collimating and electrostatically deflecting the ion beam. This assembly is operatively coupled to a removable ion source and a magnetic deflecting unit in such a manner that the combination of the collimating slits and the electrostatic condenser will produce parallelism of the ion beam upon entering the magnetic deflecting unit. A simple and reliable photographic plate positioner unit makes it possible to secure successive exposures without removing the photographic plate from the vacuum system.

1567

AUTOMATIC CABLE TESTER OR FAULT ANALYZER MEANS. L. J. Kabell, R. A. Richards, and A. L. Dyer (to U. S. Atomic Energy Commission). U. S. Patent 2,622,130, Dec. 16, 1952.

This apparatus automatically tests a cable having a plurality of wires for faults of excessive resistance or insulation leakage of the individual wires.

1568

ION SOURCE. R. W. Thompson (to U. S. Atomic Energy Commission). U. S. Patent 2,621,296, Dec. 9, 1952.

The apparatus and method described are particularly suited to generating ions of heavy metals from vaporizable compounds of the metal in vacum. The ratio of different ions produced is quite constant and controllable.

1569

RADIATION DETECTION AND MEASURING MEANS. H. D. Le Vine and H. J. Di Giovanni (to U. S. Atomic Energy Commission). U. S. Patent 2,620,446, Dec. 2, 1952.

The response of this portable radiation detection instrument continuously increases with increase in the level of radioactivity up to several hundred roentgens per hour. The circuit employed measures the direct current component of the Geiger tube discharge current and requires no amplifying equipment.

1570

ANALYZER. Q. A. Kerns, L. W. Whitcomb, and E. E. Brown (to U. S. Atomic Energy Commission). U. S. Patent 2,620,256, Dec. 2, 1952.

This analyzer and recorder for continuously and simultaneously recording the relation between two variables has two movable elements, a table and a stylus, disposed transversely with respect to each other, each being controlled by a phase-sensitive motor responsive to one of the two variable quantities to continuously plot their relation.

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses.

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers.

For a list of the abbreviations used in this section, see NSA, Vol. 7, No. 1, page "SUPPLEMENT 1".

$_{2}He^{3}_{1}$ I 1/2 M

G.Weinrich, V.W.Hughes, BAPS 28, 1, UA2(1953).

$_{2}He^{5}_{3}$ Level $H^3(d,n)He^4$ E_n=0.01 to 1.73 pc
16.65 J = 3/2 +
σ_{max} = 5.1 ± 0.1 for E_d = 0.109

J.P.Conner, T.W.Bonner, J.R.Smith, Phys. Rev. 88, 468(1952).

$_{2}He^{6}_{4}$ τ 0.848 $Be^9(n,\alpha)$

G.Vendryes, Ann. Phys. 7, 655(1952).

$_{3}Li^{5}_{2}$ Level $He^3(d,p)He^4$ E_d=0.19 to 1.60 pc
16.78 J = 3/2 +
σ_{max} = 0.69 for E_d = 0.400

T.W.Bonner, J.P.Conner, A.B.Lillie, Phys. Rev 88, 473(1952).

$_{3}Li^{6}_{3}$ No 3.58 level by $Li^6(d,d)$ E_d = 7.70 s π
3.58 level was observed by $Li^6(p,p)$

C.P.Browne, C.K.Bockelman, W.W.Buechner, A.Sperduto, BAPS 28, 1, C9(1953).

$_{3}Li^{7}_{4}$ Level $Li^6(d,p)$ E_d = 1.5
γ 0.477 sl pe^-

R.G.Thomas, T.Lauritsen, Phys. Rev. 88, 969(1952).

$_{4}Be^{7}_{3}$ Level $Li^6(d,n)$ E_p = 1.8
γ 0.429 sl pe^-

R.G.Thomas, T.Lauritsen, Phys. Rev. 88, 969(1952).

$_{4}Be^{10}_{6}$ Levels $Be^9(d,p)$ E_d = 14.3
d,p(θ) g.s. l_n = 1
(3.37) l_n = 1

C.F.Black, BAPS 28, 1, w10(1953).

Level Be(d,p) E_d = 1.2
γ (3.38) E1 or E2 e^+ spectrum

R.G.Thomas, T.Lauritsen, Phys. Rev. 88, 969(1952).

$_{5}B^{10}_{5}$ |q| 0.105 Solid $B(CH_3)_3$ Mic

H.G.Dehmelt, Z. Phys. 133, 528(1952).

No 1.74 level by $B^{10}(d,d)$ E_d = 6.9 s π
1.74 level was observed by $B^{10}(p,p)$

C.K.Bockelman, C.P.Browne, A.Sperduto, W.W. Buechner, BAPS 28, 1, C8(1953).

$_{5}B^{11}_{6}$ |q| 0.051 Solid $B(CH_3)_3$ Mic

H.G.Dehmelt, Z. Phys. 133, 528(1952).

$_{6}C^{12}_{6}$ Level $C^{12}(n,n\alpha)Be^8$ g.s. $E_n \sim 25$ cc
9.7 Γ = 1.6

J.D.Jackson, D.I.Wanklyn, BAPS 28, 1, W6(1953).

Level $N^{15}(p,\alpha)$ E_p = 1.8
γ 4.44 sl Cpt
$\tau < 3 \times 10^{-13}$ s Doppler correction

R.G.Thomas, T.Lauritsen, Phys. Rev. 88, 969(1952).

$_{6}C^{13}_{7}$ Level C(d,p) E_d = 1.5
γ 3.082 E1 e^+ spectrum sl pe^-
$\tau < 3 \times 10^{-13}$ s Doppler correction

R.G.Thomas, T.Lauritsen, Phys. Rev. 88, 969(1952).

Level $C^{13}(p,p)$ E_p = 8 s
3.69

J.C.Arthur, A.J.Allen, R.S.Bender, H.J.Hausman, C.J.McDole, Phys. Rev. 88, 1291(1952).

$_{6}C^{14}_{8}$ Level $C^{13}(d,p)$ E_d = 1.8
γ 6.11 sl pe^-

R.G.Thomas, T.Lauritsen, Phys. Rev. 88, 969(1952).

$_{7}N^{14}_{7}$ γ's $C^{13}(d,n\gamma)$ E_d = 1.5
0.725* 3.38 sl pe^- Cpt
1.638 5.05
2.31 5.69

*Assignment uncertain

R.G.Thomas, T.Lauritsen, Phys. Rev. 88, 969(1952).

$_{7}N^{14}_{7}$

No 2.31 level by N(d,d) $E_d = 6.98$ s77
2.31 level was observed by N(p,p)

C.P.Browne, C.K.Bockelman, W.W.Buechner, A.Sperduto, BAPS 28, 1, C9(1953).

$_{8}O^{16}_{8}$

Level	$O^{16}(p,p)$	$E_p = 8$	s
	6.0		
	6.1		

Doublet separation = 0.087 ± 0.010

J.C.Arthur, A.J.Allen, R.S.Bender, M.J.Hausman, C.J.McDole, Phys. Rev. 88, 1291(1952).

Levels	$F^{19}(p,\alpha\gamma)$	$E_p = 0.874, 0.935$
$\alpha\gamma(\theta)$	(6.91) I = 2 +	s77 scin
	(7.12) I = 1 −	

J.Seed, A.P.French, Phys. Rev. 88, 1007(1952).

Levels	$F^{19}(p,\alpha\gamma)$	$D(\gamma,p)$ in ppl
γ polarization	(6.91) even	
	(7.12) odd	

L.W.Fagg, S.S.Hanna, Phys. Rev. 88, 1205(1952).

$_{8}O^{17}_{9}$

Level	O(d,p)	$E_d = 1.5$	
γ	0.871	$\alpha = 7 \times 10^{-6}$	sl pe⁻ ce⁻

R.G.Thomas, T.Lauritsen, Phys. Rev. 88, 969(1952).

Levels	$F^{19}(d,\alpha)$		$E_d = 1.8, 2.0$	s
	0.883	5.229	5.95	
	3.069	5.397	6.87	
	3.856	5.723	6.99 ?	
	4.567	5.875	7.37 ?	

Relative intensities given

H.A.Watson, W.W.Buechner, Phys. Rev. 88, 1324 (1952).

$_{9}F^{19}_{10}$

Levels	$F^{19}(p,p)$		$E_p = 8$	s
	1.37	3.94	4.48	
	1.59	4.06	4.59	
	2.82	4.41	4.76	

J.C.Arthur, A.J.Allen, R.S.Bender, M.J.Hausman, C.J.McDole, Phys. Rev. 88, 1291(1952).

Levels	$Ne^{21}(d,\alpha)$	$E_d = 2.129$	s
	0.113		
	0.192		

C.Milelkowsky, W.Whaling, Phys. Rev. 88, 1254 (1952).

$_{9}F^{20}_{11}$

β^-	5.41	F-K plot linear
γ	1.631	

No $\beta^- > 5.4$ (< 1%) No $\gamma > 1.67$ (< 0.25%)
F^{19}(1.8-Mev d,p); sl pe⁻

D.E.Alburger, Phys. Rev. 88, 1257(1952).

Level	$F^{19}(d,p)$	$E_d = 14.3$
d,p(θ)	g.s.	$l_n = 2$

C.F.Black, BAPS 28, 1, W10(1953).

Levels	$F^{19}(d,p)$			$E_d = 1.5$ to 2.1	s
0.652	1.309	2.870	3.586	4.275	
0.828	1.970	2.966	3.681	4.310	
0.938	2.048	3.491	3.961	5.062?	
1.059	2.195	3.528	4.079		

Relative intensities given

H.A.Watson, W.W.Buechner, Phys. Rev. 88, 1324 (1952).

$_{10}Ne^{20}_{10}$

Resonances	$F^{19}(p,\alpha)O^{16}$		s77 scin
	E_p	J	
$\alpha\gamma(\theta)$	0.669	1 +	
$\alpha\gamma(\theta), p\gamma(\theta)$	0.874	2 −	
$\alpha\gamma(\theta)$	0.935	1 +	

J.Seed, A.P.French, Phys. Rev. 88, 1007(1952).

Resonances	$F^{19}(p,\alpha)O^{16}$ g.s.				pc
p,α(θ)	E_p	J	Rel. Yield	Γ	
	1.09*		0.13*	0.03*	
	1.23		0.26*	0.08*	
	1.38	2 +	1.0	0.10*	
	1.73	0 +	3.0	0.10*	
	1.91	1 −	6.0	0.20*	

E.B.Paul, R.L.Clarke, W.T.Sharp, BAPS 28, 1, W8 (1953); *verbal report.

$_{11}Na^{22}_{11}$

γ	(1.28)	$\alpha = 7 \times 10^{-6}$	s ce⁻

G.Hinman, D.Brower, R.Leamer, BAPS 28, 1, S7 (1953).

$_{11}Na^{24}_{13}$

Capture γ's	$Na^{23}(n,\gamma)$		2 crystal scin s	
50†	0.48	5†	1.66	
18†	0.86	11†	2.0	
10†	1.34	24†	2.53*	

†Photons per 100 n captures*

J.T.Braid, BAPS 28, 1, J5(1953); *verbal report.

Capture γ's	$Na^{23}(n,\gamma)$		sl pe⁻, Cpt	
60†	0.475	20†	2.07	
50†	0.877	30†	2.52	
20†	1.75			

†Photons per 100 n captures*

M.T.Motz, BAPS 28, 1, J8(1953); *verbal report.

Neutron resonances $E_n = 0.12$ to 1
12 resonances, Γ's, J's

P.M.Stelson, W.M.Preston, Phys. Rev. 88, 1354 (1952).

Mg	Levels	Mg(p,p)	$E_p = 8$	s
		3.54		
		4.71		
		5.03		

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

$_{12}Mg^{24}_{12}$

Levels	Mg(p,p)	Al(p,α)	$E_p = 8$	s
	1.38			
doublet	4.13			
	4.24			

g.s. α group not observed

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

$_{12}Mg^{25}_{13}$

Levels	Mg(p,p)		$E_p = 8$	s
	0.61	2.76	complex ?	
	1.62	3.41		
	1.98	3.91		
	2.56			

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Mg^{26} 12 14

	γ			pγ scin
1.83 level	1.83			
2.97 level	1.14(6†)	2.97(1†)	1.83(6†)	
3.97 level	2.14	3.97(vw)	1.83	
4.35 level	1.38	1.14	1.83	

J.E.May, B.P.Foster, BAPS 28, 1, S8(1953).

Levels Mg(p,p) s
1.83
2.96

M.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Al^{27} 13 14 Levels Al(n,n) E_n = 2.4 scin
0.35 ?
~0.9

W.J.Poole, Phil. Mag. 43, 1060(1952).

Al^{28} 13 15 Levels Al(d,p) E_d = 2.1 s ppl

0.031	2.652	3.873	4.734	5.372
0.974	2.980	3.900	4.759	5.435
1.015	3.006	3.932	4.837	5.735
1.367	3.291	4.031	4.898	5.755
1.625	3.342	4.115	4.988	5.792
2.137	3.458	4.238	5.007	5.855
2.198	3.532	4.307	5.128	6.011
2.268	3.587	4.457	5.156	6.190
2.484	3.665	4.512	5.169	6.307
2.578	3.695	4.686	5.182	

Relative intensities given

H.A.Enge, W.W.Buechner, A.Sperduto, Phys. Rev. 88, 963(1952).

Al^{29} 13 16 γ 85† 1.28 scin
15† 2.43
No 2.04γ (< 4%)

H.Roderick, O.Lönsjö, W.E.Meyerhof, BAPS 28, 1, S9(1953).

Si^{29} 14 15 Levels Si(d,p) E_d = 14.3
d,p(θ) g.s. l_n = 0
(1.29) l_n = 2

C.F.Black, BAPS 28, 1, W10(1953).

Si^{31} 14 17 τ 2.62h
β^- 1.48 a

A.Wennerblom, K.E.Zimen, E.Ehn, Svensk Kem. Tid. 63, 207(1951).

τ 2.62h P(d,2p) chem; ic

L.J.de Vries, F.T.M.Veringa, J.Clay, Koninkl. Ned. Akad. Wetenschap., Proc. 55B, 303(1952).

P^{29} 15 14 τ 4.45s Si^{28}(2.8-Mev d)
γ 0.5% (1.28) scin
2.5% (2.43)
(1.28γ)(0.511γ) (2.43γ)(0.511γ)
No 0.39, 0.76, 1.15, or 2.04γ

H.Roderick, O.Lönsjö, W.E.Meyerhof, BAPS 28, 1, S9(1953).

P^{31} 15 16 Neutron resonances P(n,p)2.6hSi
E_n = 2.05 to 3.25

2.25	2.55	2.87	3.15
2.37	2.70	3.02 ?	3.22

I.Nilsson, Trans. Chalmers Univ. Technol., Gothenburg No. 125(1952).

P^{32} 15 17 Levels P^{31}(d,p) E_d = 14.3
d,p(θ) g.s. l_n = 2
~1.2* l_n = 0*

C.F.Black, BAPS 28, 1, W10(1953); *verbal report.

Levels P^{31}(d,p) E_d = 7.8 pc
d,p(θ) g.s. l_n = 2
(0.08) l_n = 2
(0.52) l_n = 0(22%), 2(78%)
(1.16) l_n = 0(33%), 2(67%)
(1.3) l_n = 0(57%), 2(43%)

J.S.King, E.H.Beach, BAPS 28, 1, W9(1953); verbal report.

Capture γ's P^{31}(n,γ) 2 crystal scin s
37† 0.51
17† 1.13
41† 2.19
†Photons per 100 n captures*

J.T.Braid, BAPS 28, 1, J5(1953); *verbal report.

S^{32} 16 16 Levels S^{32}(p,p) E_p = 8 s

2.25	4.50	5.04	
3.81	4.74	5.83	
4.32			

J.C.Arthur, A.J.Allen, R.S.Bender, M.J.Hausman, C.J.McDole, Phys. Rev. 88, 1291(1952); 87, 237A (1952).

S^{33} 16 17 Levels S(d,p) E_d = 14.3
d,p(θ) g.s. l_n = 2
(0.79) l_n = 0

C.F.Black, BAPS 28, 1, W10(1953).

Capture γ's S(n,γ) 2 crystal scin s
60† 0.84
~1.52
40† 2.34
†Photons per 100 n captures*

J.T.Braid, BAPS 28, 1, J5(1953); *verbal report.

Cl^{36} 17 19 Capture γ's Cl(n,γ) 2 crystal scin s

0.48	1.85*
0.75	2.15*
1.14	2.84

J.T.Braid, BAPS 28, 1, J5(1953); *verbal report.

K^{40} 19 21 D_2 factor corrects F-K plot cc

J.H.Marshall, BAPS 28, 1, S10(1953).

$\Delta M(K^{40}-Ca^{40})$ = 1.30 ±0.07 Mev ms
$\Delta M(K^{40}-A^{40})$ = 1.49 ±0.07 Mev

W.H.Johnson, Jr., Phys. Rev. 88, 1213(1952).

Ca^{41} (20 21)

Levels — Ca(d,p) — $E_d = 14.3$

$d,p(\theta)$		l_n
	g.s.	3
	(1.95)	1

C.F.Black, BAPS 28, 1, W10(1953); verbal report.

Ca^{48} (20 28)

$\tau_{\beta\beta}$ $> 10^{14}$ y — ppl

Assuming decay energy ≥2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Sc^{46} (21 25)

Level — $Sc^{45}(d,p)$ — $E_d = 7.8$ — pc

$d,p(\theta)$		l_n
	g.s. ?	1 (≤15%)*, 3 (≥85%)

J.S.King, E.H.Beach, BAPS 28, 1, W9(1953); *verbal report.

Ti

Capture γ's — $Ti(n,\gamma)$ — 2 crystal scin s

37†	0.33
~100†	1.4

†Photons per 100 n captures*

J.T.Braid, BAPS 28, 1, J5(1953); *verbal report.

Ti^{47} (22 25)

Levels — $Ti^{46}(d,p)$ — 82.68% Ti^{46} — pc

10†	g.s.	17†	3.09
34†	1.40	50†	3.70
13†	2.39	50†	4.18
32†	2.64		

G.F.Pieper, Phys. Rev. 88, 1299(1952).

Ti^{48} (22 26)

Levels* — $Ti^{47}(d,p)$ — 82.05% Ti^{47} — pc

10†	g.s.	150†	4.50
10†	1.33	180†	~4.9
<50†	2.31	250†	~5.2
100†	3.31		

*Longest range p group observed may go to first excited and not g.s.

G.F.Pieper, Phys. Rev. 88, 1299(1952).

Ti^{49} (22 27)

Levels — $Ti^{48}(d,p)$ — 98.90% Ti^{48} — pc

10†	g.s.	40†	2.41
90†	1.35	120†	3.11
60†	1.70		

G.F.Pieper, Phys. Rev. 88, 1299(1952).

Ti^{50} (22 28)

Levels — $Ti^{49}(d,p)$ — 77.27% Ti^{49} — pc

10†	g.s.	240†	4.88
10†	1.58	190†	5.39
<10†	3.0	330†	5.99
240†	4.14		

G.F.Pieper, Phys. Rev. 88, 1299(1952).

Ti^{51} (22 29)

Levels — $Ti^{50}(d,p)$ — 84.69% Ti^{50} — pc

10†	g.s.	8†	1.15?
3†	0.61		1.6?

G.F.Pieper, Phys. Rev. 88, 1299(1952).

V^{48} (23 25)

β^+	~95†	0.69	$Sc^{45}(\alpha,n)$	chem; sπ
	~5†	~0.82		
γ		(0.99)		scin
	100†	(1.32)		
	2†	(2.22)		

(0.511γ)(0.99γ) (0.511γ)(1.32γ) (0.511γ)(2.2γ) (1.32γ)(0.99γ) No(0.99γ)(2.2γ) No(1.32γ)(2.2γ)

γγ(θ) indicates I = 4, 2, 0

No ce^- between 0.070 and 0.12

P.L.Roggenkamp, C.M.Pruett, R.G.Wilkinson, Phys. Rev. 88, 1262(1952).

V^{50} (23 27)

$\tau_{\varepsilon,\alpha}$ $> 10^{12}$ y

S.G.Cohen, Bull. Research Council Israel 2, 195 (1952).

V^{51} (23 28)

Levels — V(p,p) — $E_p = 8$ — s

0.33	2.43	3.83
0.48	2.65	3.96
1.16	3.11	4.90
1.84	3.41	4.97
2.22	3.58	

No level at 0.287 by (p,p)

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

V^{52} (23 29)

Level — $V^{51}(d,p)$ — $E_d = 7.8$ — pc

$d,p(\theta)$		l_n
	g.s.	1 (≥75%), 3 (≤25%)

J.S.King, E.H.Beach, BAPS 28, 1, W9(1953).

Cr

Levels — Cr(p,p) — $E_p = 8$ — s

0.48	3.20	3.80
0.81	3.46	3.99
2.69	3.51	4.07
2.79	3.65	4.78

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Cr^{52} (24 28)

Levels — Cr(p,p) — $E_p = 8$ — s

1.45
2.43
2.99

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

Cr^{53} (24 29)

Level — Cr(d,p) — $E_d = 14.3$.

$d,p(\theta)$		l_n
	g.s.	1

C.F.Black, BAPS 28, 1, W10(1953).

Cr^{54} (24 30)

$\tau_{\beta\beta}$ $> 6 \times 10^{15}$ y — ppl

Assuming decay energy ≥2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Mn^{55} (25 30)

Levels — $Mn^{55}(p,p)$ — $E_p = 8$ — s

0.13	2.27	3.05
1.00	2.42	3.21
1.30	2.59	3.31
1.56	2.77	3.42
1.91	2.85	3.64

H.J.Hausman, A.J.Allen, J.S.Arthur, R.S.Bender, C.J.McDole, Phys. Rev. 88, 1296(1952).

$_{26}Fe^{56}_{30}$ Level Fe(n,n) $E_n = 2.4$ scin
(0.85)

W.J.Poole, Phil. Mag. 43, 1060(1952).

$_{26}Fe^{57}_{31}$ Levels Fe(d,p) $E_d = 14.3$
d,p(θ) g.s. $l_n = 1$
~1.4 $l_n = 1$
~2.6 $l_n = 1$

C.F.Black, BAPS 28, 1, W10(1953).

$_{26}Fe^{58}_{32}$ $\tau_{\beta\beta}$ $>3 \times 10^{14}$ y ppl
Assuming decay energy ≥2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

$_{26}Fe^{59}_{33}$ γ (1.10) $\alpha = 1.8 \times 10^{-4}$ s ce⁻
(1.30) $\alpha = 1.1 \times 10^{-4}$

G.Hinman, D.Brower, R.Leamer, BAPS 28, 1, S7 (1953).

β⁻ 46% 0.271 F-K plot linear s1
54% 0.462 F-K plot linear
0.3% 1.560 F-K plot not α or D_2
γ 2.8% 0.191 $\alpha = 7 \times 10^{-3}$ M1
57% 1.098 $\alpha = 1.8 \times 10^{-4}$ M1
43% 1.289 $\alpha = 1.4 \times 10^{-4}$ E2
(0.19γ)(1.1γ) Fe^{58}(pile n,γ); s1 ce⁻ pe⁻
γγ(θ) agrees with I = 3/2, 5/2, 7/2 scin

F.R.Metzger, Phys. Rev. 88, 1360(1952).

$_{27}Co^{58}_{31}$ $_{72^d}$ |μ| 3.5* γ(θ,T)
0.805γ is not dipole γ(θ,T)
*Based on I = 2

J.W.Daniels, M.A.Grace, H.Halban, N.Kurti, F.N.H. Robinson, Phil. Mag. 43, 1297(1952).

γ (0.805) Electric multipole
Polarization from low temp. aligned nuclei

G.R.Bishop, J.W.Daniels, G.Goldschmidt, H.Halban, N.Kurti, F.N.H.Robinson, Phys. Rev. 88, 1432 (1952).

$_{27}Co^{60}_{33}$ $_{5.2^y}$ |μ| 3.5 γ(θ,T)
Value of 3.0 (Phys. Rev. 85, 688.) in error

B.Bleaney et al., quoted by J.W.Daniels et al., Phil. Mag. 43, 1297(1952).

γ (1.17) Electric multipole
(1.33) Electric multipole
Polarization from low temp. aligned nuclei

G.R.Bishop, J.W.Daniels, G.Goldschmidt, H.Halban, N.Kurti, F.N.H.Robinson, Phys. Rev. 88, 1432 (1952).

$_{28}Ni^{64}_{36}$ $\tau_{\beta\beta}$ $>3 \times 10^{15}$ y ppl
Assuming decay energy ≥2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

$_{29}Cu^{62}_{33}$ τ 9.80 m

J.Goldenberg, M.D.Sousa-Santos, E.Silva, Ciencia cultura 3, 307(1951); Chem. Abst. 46-10926(1952).

$_{30}Zn^{70}_{40}$ $\tau_{\beta\beta}$ $>10^{15}$ y
Assuming decay energy ≥2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

$_{32}Ge^{76}_{44}$ $\tau_{\beta\beta}$ $>2 \times 10^{16}$ y ppl
Assuming decay energy ≥2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

$_{35}Br^{79}_{44}$ $q(Br^{79})/q(Br^{81}) = 1.1987$ Solid $C_6H_4Br_2$ Mic

E.Manring, C.Brown, D.Williams, BAPS 28, 1, F4, (1953).

$_{35}Br^{82}_{47}$ γ 388† 0.535 s
0.602
353† 0.750
100† 1.02
85† 1.29
40† 1.45

B.Dzhelepov, A.Sliant'ev, Doklady Akad. Nauk SSSR. 85, 533(1952); NSA 6-6197(1952).

$_{35}Br^{84}_{49}$ γ st 0.890 scin
w 1.89

L.M.Langer, R.B.Duffield, Quoted by C.W.Huddleston, A.C.G.Mitchell, Phys. Rev. 88, 1350(1952).

$_{36}Kr^{83}_{47}$ τ 1.86^h

L.J.de Vries, F.Th.H.Veringa, J.Clay, Koninkl. Ned. Akad. Wetenschap., Proc. 55B, 303(1952).

$_{37}Rb^{82}_{45}$ β⁺ 24† 0.175 Br(<20-Mev α); s1
76† 0.775
γ 0.188 0.464 0.818 ce⁻ pe⁻
0.248 0.550 1.020
0.322 0.610 1.314
0.389 0.690 1.464
0.423 0.768 v st

C.W.Huddleston, A.C.G.Mitchell, Phys. Rev. 88, 1350(1952).

$_{37}Rb^{84}_{47}$ β⁺ ~3† 0.37 ? Br(<20-Mev α); sπ, s1
58† 0.82
39† 1.629 ΔI = 2, yes shape
γ 0.890 scin, sπ, ce⁻
No other γ No β⁻ (vw if present)
(~0.8β⁺)(γ) No (1.63β⁺)(γ)

C.W.Huddleston, A.C.G.Mitchell, Phys. Rev. 88, 1350(1952).

$_{37}Rb^{86}_{49}$ βγ polarization - direction
1.08γ no parity change

D.R.Hamilton, A.Lemonick, F.W.Pipkin, BAPS 28, 1, S4(1953); verbal report.

$_{37}Rb^{87}_{50}$ τ 5.90×10^{10} y RbI(Tl) scin
β⁻ 0.275 F-K plot not linear
No ce⁻ or γ

G.W.Lewis, Phil. Mag. 43, 1070(1952).

$_{38}Sr^{88}_{50}$ $\tau_{\beta\beta}$ $> 3 \times 10^{16}$ y ppl

Assuming decay energy $\geq$ 2 Mev

J.H.Fremlin, M.C.Walters, Proc. Phys. Soc. 65A, 911(1952).

Neutron Cross Sections

Reaction	σ Type	Value	Energy	Ref.
H(n)	σ_t as f(T) for H_2		~0.034 ev	52g2
H(n)	σ_t	3.38	1.32	53s1
H(n)	σ_t	0.037	390	53h1
He(n)	σ_t	0.200	84	53h2
$Li^6(n,t)He^4$		25 mb	14	53f1
$Li^6(n,d)He^5$		~140 mb*	14.2	52r1
$Li^6(n,d)He^5$ g.s.		80 mb	14	53f1
$Li^6(n,d')He^5$ excited		81 mb	14	53f1
$Li^6(n,p)He^6$		6 mb	14	53f1
$Li^7(n,t)He^5$		53 mb	14	53f1
C(n)	σ_t	2.21	1.32	53s1
C(n)	σ_t	0.287	390	53h1
O(n)	σ_t	1.58	14.1	52c1
Na^{23}(n)	σ_t	graph	0.12 - 1	52s1
$Al^{27}(n,\alpha)$	$\sigma(15.0^h Na)$	0.135	14.1	52f1
$Al^{27}(n,p)$	$\sigma(9.6^m Mg)$	0.079	14.1	52f1
$P^{31}(n,p)$	$\sigma(2.6^h Si)$	0.091	14.1	52f1
S(n)	σ_t	2.06	13.3	52a1
$Fe^{56}(n,p)$	$\sigma(2.6^h Mn)$	0.124	14.1	52f1
Cu(n)	σ_t	3.1	13.3	52a1
Cu(n)	σ_t	2.96	14.1	52c1
$Cu^{63}(n,2n)$	$\sigma(9.9^m Cu)$	0.510	14.1	52f1
$Cu^{65}(n,2n)$	$\sigma(12.8^h Cu)$	0.970	14.1	52f1
$Cu^{65}(n,p)$	$\sigma(2.56^h Ni)$	0.019	14.1	52f1

* Erroneously reported as ~14 mb, NSA 6, #20(1952).

52a1 M.Agenc, G.Cortellessa, R.Querzoli, Rend. Ist. super. sanita 15, 555(1952); NSA 7, 317(1953).

52c1 J.H.Coon, E.R.Graves, H.H.Barshall, Phys. Rev. 88, 562(1952).

52f1 S.G.Forbes, Phys. Rev. 88, 1309(1952).

52g2 W.Guber, Z. Naturforsch. 7a, 725(1952).

52r1 F.L.Ribe, Phys. Rev. 87, 205A(1952).

52s1 P.H.Stelson, W.M.Preston, Phys. Rev. 88, 1354(1952).

53h1 A.J.Hartzler, R.T.Siegel, BAPS 28, 1, M3(1953); verbal report.

53h2 P.Hillman, R.H.Stahl, BAPS 28, 1, M4(1953); verbal report.

53s1 C.L.Storrs, D.H.Frisch, BAPS 28, 1, C4(1953); verbal report.

Ground State Q's

Reaction	Standard	Value	Energy	Meth
$N^{14}(d,p)N^{15}$	Po^{212} α	+8.613 ±0.011	1.354	s
$Ne^{21}(d,\alpha)F^{19}$	Bi^{212} α	+6.432 ±0.010	2.129	s
$Ne^{21}(d,p)Ne^{22}$	Po^{212} α	+8.137 ±0.011	1.354	s
$Na^{23}(d,p)Na^{24}$	Bi^{212} α	+4.723 ±0.008	2.129	s

C.Milelkowsky, W.Whaling, Phys. Rev. 88, 1254(1952).

$Al^{27}(\alpha,p)Si^{30}$		+2.26 ±0.05	4.0	ppl

R.R.Roy, J.Quequin, P.Janssens, Bull. centre phys. nucleaire univ. libre Bruxelles, No. 31(1951); Phys. Abst. 55-7540(1952).

$Ti^{46}(d,p)Ti^{47}$	$O^{16}(d,p)$	+6.45 ±0.05		range
$Ti^{47}(d,p)Ti^{48}$	$O^{16}(d,p)$	+8.14 ±0.05 ?		range
$Ti^{48}(d,p)Ti^{49}$	$O^{16}(d,p)$	+5.81 ±0.04		range
$Ti^{49}(d,p)Ti^{50}$	$O^{16}(d,p)$	+8.62 ±0.05		range
$Ti^{50}(d,p)Ti^{51}$	$O^{16}(d,p)$	+4.11 ±0.07		range

G.F.Pieper, Phys. Rev. 88, 1299(1952).

Packing Fraction Differences, Δf, in Units 10^{-4} amu

Doublet	Δf	Ref.
$Ni^{61} - Te^{122}$	-3.43 ±0.05	52h4
$Ni^{62} - Te^{124}$	-3.71 ±0.03	52h4
$Ni^{64} - Te^{128}$	-3.81 ±0.05	52h4
$Cu^{65} - Te^{130}$	-3.95 ±0.03	52h4
$A^{40} - C_2O$	-8.186 ±0.005	52j1
$K^{40} - C_2O$	-7.78 ±0.02	52j1
$Ca^{40} - C_2O$	-8.139 ±0.002	52j1

52h4 B.G.Hogg, H.E.Duckworth, Can. J. Phys. 30, 628(1952).

52j1 W.H.Johnson, Jr., Phys. Rev. 88, 1213(1952).